AC and other line topics

Date: Sun, 9 Nov 1997 08:02:09 +0500
From: "Chuck Rippel" <crippel@...>
Subject: [R-390] Re: Help please GFI problem

> Subject: Help please GFI problem
> Chuck, you may have once posted suggestions to me or to the reflector
> regarding the apparently naturally-ocurring leakage at the line filter
> which then trips my GFI in my modern home. I wired in a nice 3-wire
> grounded cord and plug to my 390A, and tripped the GFI in the bathroom
> adjacent to the shack, taking out the power to the radio. Now, I just am
> using a 2-pin adapter at the end of my 3-pin plug, so I've effectively
> undone the update I installed.

The 390 will not work in a GFI outlet. Wasn't made to pass UL in 1954.

> Is there a simple fix to the radio? I'm getting all kinds of
> theories from local (well-meaning) ham-friends, but would really
> appreciate hearing from you on this. As always, thanks for all your
> help. Would like the venerable old radio to be happy in the modern home,
> with me the operator safe from annoying "tingles" or worse.

I'd put on a 3 wire cord. I do on all the ones I restore. There is actually a military mod for it. It's kinda tricky to make sure you get the polarity right in the input filter tho. The black wire should attach to the terminal on the input network that is TO YOUR >RIGHT< as you face the REAR of the radio. White, or neutral is to the left. The ground lug goes on the screw which holds the protective cover over the input network. Hope that helps.

Date: Sun, 9 Nov 1997 08:35:40 -0500
From: Don Stepka <dts4@...>
Subject: Re: [R-390] Re: Help please GFI problem

The line filter has about .05-.1uF from each leg of the AC to ground. The primary purpose (i.e., the reason the caps are so large) is to prevent signals from leaking OUT of the 390. If this is not a problem (and it shouldn't be, unless you are trying to make sure a submarine can't target your house), then replace the filter with a .001 from just one leg to chassis. If you use a 3-wire cord (or polarized 2-wire), you can choose the neutral leg.

Date: Wed, 12 Nov 1997 00:24:33 -0500
From: Don Stepka <dts4@...>
Subject: Re: [R-390] Re: Help please GFI problem

No magic. The root of the need for line-to-chassis caps is RF leakage. RF can leak into the radio on the power line, and it can leak out. If the line is not bypassed to chassis, crud on the power line (from motors, fluorescent lights, dimmers, etc.) gets into the radio and raises the interference level. The .001 uF value I recommended is the traditional value used by radio manufacturers for decades to solve this problem. The traditional approach bypasses only one side of the line because the capacitive coupling of the two phases in house wiring and in the radio's power cord is pretty good at HF, so the one bypass is sufficient to
eliminate line-borne RF interference.

The reactance of the .001 uF capacitor at 60 cps is around 3 M ohms, so even if it is connected from the hot side of the line to chassis you get only around 40 uA of ground leakage, not enough to trip most GFIs. (Of course, if it is connected from the neutral side of the line to chassis the ground leakage will be much lower.) In the old non-polarized, non-grounded plug days, the leakage current could potentially flow through the operator to ground from the chassis, and the .001 uf / 40 uA possible leakage current was chosen to limit the risk of shock. Those with VTVMs could measure the chassis potential and plug the radio in such that the neutral leg was the one bypassed to chassis. In these grounded-plug days, any leakage current flows through the ground wire and the GFI (if any).

The 390 series radios were designed to be low-radiation devices so that their installations would not give themselves away to an enemy using direction-finding receivers, particularly in seagoing (i.e., low-background-noise) missions. This requirement called for better bypassing than the interference requirement above calls for, so the 390 series designs have both sides of the line bypassed to chassis with larger capacitors. This has two effects: because both sides of the line are bypassed, no matter which way you plug it in the chassis floats at half line voltage; and the leakage current is much higher (as much as several mA) -- high enough to trip GFIs with authority (you can easily draw sparks from the (ungrounded) chassis to ground). Since most of us have no reason to Tempest-certify our shacks, the .001 uF bypass on one power leg is the better choice for us. It does a perfectly good job of preventing line-borne RF interference without risking shock or GFI problems. The best technique is to install a 3-wire cord and bypass the neutral leg to chassis with the .001 uF capacitor, so the 60 cps ground leakage will be almost nil. Of course, the capacitor chosen should have a self-resonant frequency well above the high-frequency limit of the radio, and should withstand 120 VAC continuously with a large safety margin. 1000 V disk ceramics are a good choice. Don

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From: Walter Dail <dail@...>
Date: Mon Jan 12, 1998 5:39 am
Subject: [R-390] FL-101 AC Input Filter

In my Amelco R-390A, I am finding that I am having excessive AC leakage to ground(very unsafe!). Anyway, I suspect the AC input filter FL-101 has bad caps. Since this is a sealed unit, I guess I should remove it totally from the circuit. I was wondering if anyone else has had this problem, and what did you do to solve it. I really hate taking parts out of my radio, since I want it to be EXACTLY like the factory built it, but I have to be safe too. Any suggestions?

From: "Dr. Gerald N. Johnson, P.E." <geraldj@...>
Date: Mon Jan 12, 1998 7:48 am
Subject: Re: [R-390] FL-101 AC Input Filter

The original caps are probably large enough to cause what today is excess leakage. Most radios of the 50s and 60s had .01 to .05 mf from each side of the line to the chassis. Enough to cause a shock when the radio wasn't grounded. Add a little leakage from rotten caps and things get lively. Unless this "excess" leakage is tripping the GFI in the power line and you don't have the chassis grounded, the power line should eventually fry the bad cap, hopefully open. Then you won't have such a problem. But any radio of that vintage without a ground on the chassis will tickle.

From: "Dr. Gerald N. Johnson, P.E." <geraldj@...>
Date: Tue Jan 13, 1998 7:24 am
Subject: Re: [R-390] FL-101 Input Filter Comments

Strictly speaking, Walter, the current to ground through the bypass capacitors is NOT power but purely reactive current (e.g. 90° out of phase with the applied voltage) and doesn't make the KWH meter move. So there's only a tiny waste of power from the losses in the series resistance of the current in the power wires. And that's barely detectable but NOT registered on the KWH meter either.

Date: Sun, 23 May 1999 12:44:00 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] FAQ Page Updates

Al, I agree with the concept but I object to your circuit... First you raise the receiver neutral line away from ground. That means there's 12 volts to ground on the neutral even with the receiver power switch off. That's NOT good. Then you have full elevated line voltage on the transformer primary, that's inefficient wasting more power in core losses than needed.

It would be safer and more efficient to connect the transformer secondary on the high line input side of the transformer so you lower the voltage on the transformer primary and so lower its energy wasted in core saturation

(precisely what you are trying to do for the R-390) and you maintain the neutral wire unbroken... In your picture, spin your transformer and windings (including pri/sec labels but not voltage labels) 180∞.

Its best to experiment with the connections to get the polarity correct in this manner. Connect a lead from the transformer secondary to the high side of the transformer primary and apply voltage (6 to 125) to the transformer primary. Check the voltage from the open end of the secondary to the low side of the transformer primary. If its less than the applied voltage, swap the secondary leads (with power off). If its greater, its correct. Then for use, apply the high line voltage (127 or so) to the series connection of the two windings, and connect the receiver load across the original primary alone.

Besides filament transformers there are transformers made with 12/24 or 16/32 secondaries and 120/240 volt primaries specifically for the purpose.

Weekend before last, I did that with a 45 KVA 3 phase 480/208 transformer to let it run cold with 250 three phase applied to what had been the 208 volt winding to supply power for a LARGE 440 volt planer in a wood working shop. There I had to add the windings, but fortunately there was room in the air cooled transformer.

Date: Sun, 23 May 1999 16:22:21 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] FAQ Page Updates

You're right, Jerry!

That's a code violation, too. Swap the black and white so the neutral goes straight through and stays at ground potential.

Date: Sun, 23 May 1999 20:03:05 -0400
From: Al Tirevold <tirevold@mindspring.com>
Subject: Re: [R-390] FAQ Page Updates

Jerry, Thanks for the advice about the circuit.

The FAQ page has been corrected.

Sheesh - I was taught to do it the other way by a licensed electrician. I've done it several times that way without mishap - I guess I was lucky. I also added a warning about unfused/unswitched devices in the power path.

Date: Sun, 23 May 1999 20:17:57 -0500

From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] FAQ Page Updates

You'd have great fireworks if you wired it your way on all three phases of a y connected 208 system... Neutrals 19 volts apart shorted together!

Date: Mon, 24 May 1999 08:59:39 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] FAQ Page Updates

Closer but badly labeled and connected. WHITE is neutral in power wiring and you NEVER break WHITE. Sure it turns the radio off, but leaves the wires floating at 120 volts. Leads to dead radiomen, at worst, or to burned fingers and tools at least. And is a code violation. Swap your white and black labels...

Date: Tue, 13 Jul 1999 15:30:40 -0400
From: Bob Login <jlogin@mindspring.com>
Subject: [R-390] Ground-fault problems

Hi---Just moved into new QTH with ground-fault ac socket. Keeps tripping with R390A. Disconnected ac line filter in the 390a and now rx works without tripping. Anyone else hv problems with this device in ac line? Will external ground rod eliminate the problem or are these line filters too leaky to be safe. Is this a safety issue with the 390a having ac leaking to ground?

Date: Tue, 13 Jul 1999 13:50:54 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Ground-fault problems

Could be a leaky capacitor or two in the line filter. Could just be that the capacitors are so large they pass enough 60 Hz to trip the GFI. It was a typical problem in all radios of that era that they tickle the user when not grounded, just trying to keep them from hearings signals coming in the AC line. Some have reported finding the capacitors leaky. That's not surprising since most of the other paper capacitors leak excessively.

Check back in the archives for some extended discussions on the topic.

Date: Tue, 13 Jul 1999 15:27:32 -0500
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Ground-fault problems

Are you using a 3-wire plug?

Date: Tue, 13 Jul 1999 18:25:38 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Ground-fault problems

The normal AC current through the capacitors in the line filter in the R-390A is enough to trip many GFI protection devices.

The caps are NOT leaky.
The GFI device is behaving as it should.
The solution is not a better ground.
The solution is to either:
- remove the line filter
- run the radio on a circuit NOT protected with a GFI.

It's just that simple.

Date: Wed, 14 Jul 1999 09:37:01 +1000
From: Morris Odell <morriso@vifp.monash.edu.au>
Subject: Re: [R-390] Ground-fault problems

The line filter in the R-390A is a sealed unit and not easy to modify. Despite theis the common wisdom down here is that the caps in it do not cope with 240 volts very well and need to be replaced for our higher mains voltage. There have been articles in the Australian Amateur press describing disassembly and modification of the R-390A mains filter.

I usually like to replace mains caps in old equipment anyway, and I use properly rated special mains suppression caps that are available in component stores for a dollar or two. The extra expense is well worth it when safety is an issue. These caps are designed to cope with the sometimes enormous transients that can appear on the "dirty" mains supply.

In order to avoid tripping the ELCB or getting a tingle if the earth becomes disconnected I usually connect one cap from active-to-neutral and another from neutral-to-chassis. If the earth becomes disconnected the chassis should not rise to half the mains voltage as the neutral should be pretty close to ground potential. If the active and neutral become transposed, the chassis may rise to near mains potential if the earth is disconnected, but the maximum current that will flow through a 0.01 mfd cap at 240 volts 50 Hz is only 0.75 mA - enough to trip the ELCB and usually not enough to kill anyone (unless you connect your IV line or pacemaker lead to the chassis :-)

Date: Tue, 13 Jul 1999 20:28:39 -0500
From: Richard Biddle <theprof@texoma.net>

Subject: Re: [R-390] Ground-fault problems

I had the same problem with my R-390A so I pulled the line filter and it was indeed leaky. Ordered another from Fair Radio (a pull of course). It didn't test leaky but still tripped the GFI. My supply to the R-390A now includes an isolation transformer and a Variac auto-transformer for soft start. The receiver is connected both to RF ground and AC ground (via the line cord). Doesn't bite me anymore:) I decided to take apart the old filter to see if I could rebuild it. My lessons learned after the fact were something like this: Drill a small hole in the cover of the cover before starting the unsoldering process. That prevents the thing from spewing everywhere when the solder reaches the eutectic point. The potting material is a very thick wax-like substance similar to beeswax. It takes a reasonably high temperature to get this stuff to flow. And it is very difficult to it off of anything cold. Assume you will trash your clothes (see note about the small hole above:) Once all the junk is out the capacitors can be replaced without much problem. I skipped the potting compound going back together. I think I used too much heat because the case looked pretty ratty when I got through. I figure with practice it wouldn't be a big thing, but it became a don't care for my set-up.

Date: Sun, 02 Jan 2000 15:51:07 -0600
From: Tom Norris <badger@telalink.net>
Subject: [R-390] Re: Chuck's safety hints, my comments and additions.

<snip>.... Check those wall outlets! Get your VOM out, check that there is 115 (nominal) between ground screw and the narrow slot of your outlet, make sure it is NOT between the ground screw and the wide (neutral) slot of the outlet. Better yet, Radio Shack and most electrical suppliers sell a simple plug in tester to do this for you. Most of these simple and inexpensive testers give an easy to read LED indication of how the outlet is wired. It is always a good idea to contact a licensed Electrician to make sure any changes you make are per Code, or preferably to do any changes for you to make sure that they indeed are.

Date: Sun, 2 Jan 2000 16:13:35 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: [R-390] Fused Neutrals, Off Topic Posts, AND,.....Cat Stuff

The National Electrical Code says:

240-22. Grounded Conductor. (That being the Neutral, or return.) No overcurrent device shall be connected in series with any conductor that is intentionally grounded, unless one of the following two conditions are met:

1). The overcurrent device opens all conductors of the circuit, including

the grounded conductor, and is designed so that no pole can operate independently.

2). Where required by Sections 430-36 or 430-37 for motor overload protection.

- -End of code section-

The reason for this is that they don't want the fuse in the neutral line to blow by itself and leave the circuit hot. They want the neutral overcurrent device
to open the hot line, too. I kind of like it that way, fewer surprises.

Also, keep the neutral and the ground seperate, except at the service disconnect. Its not good to be putting 120 VAC on the ground, it makes electricians angry.

Don't trust a grounded outlet to actually be grounded, you'd be amazed at what I've torn out of old houses.

Check to see if your house electrical system is actually grounded, to GROUND RODS, not just the cold water pipe, which may be plastic!

Licensed electrician? HA!! The State of New York doesn't have licensing provisions for electricians!!!! Anybody can be an electrician here! Each city has their own license, ...maybe....

Date: Sun, 2 Jan 2000 20:01:25 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] ATTN: BA Owners! You might want to archive this

The R-390A usually (but not always) has the two AC power input terminals marked "A" and "B." According to the schematic, "B" is the fused and switched side and therefore should go to the hot side of the line. However, it is essential one verify this because, as has been pointed out, the wires can be reversed.

If you look at the back of a set with unmarked terminals, the right hand stud should be the "B" (hot) terminal. IMPORTANT! VERIFY your set and if necessary take steps to correct the wiring. Then add the missing "A" and "B" letters with magic marker.

Three wire (grounded) plugs and line cords are strongly recommended for ALL equipment. Just be sure to wire correctly. Most on the list know this, but American line cords usually come with a green, a white, and a black wire. Green is ground, white is neutral, and black is hot. Black goes to the

narrow blade on the plug. Computer power cords color coding can vary--just ring out the wires at the plug.

Date: Sun, 02 Jan 2000 21:24:27 -0500
From: "L. M. Picard" <lmpicard@netcom.ca>
Subject: Re: [R-390] Fused Neutrals

In the event that an overcurrent condition occurs via a short to ground a protection device on neutral alone will do nothing to prevent the risk of fire, overheating or possibly shock.

My present house was constructed around 1920. About a year after I moved in, I was surprised to learn that the main ground from the service panel was to a hot water pipe. This is despite the fact that the wiring had been updated fairly recently, judging by the types of cable used. Joe's advice is right on.

Date: Sun, 2 Jan 2000 19:43:58 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Fused Neutrals

Consider what would happen here if there was a short to ground, or someone had tied the neutral to ground, and the "ground" was the return path. This could go unnoticed for years because it would work, UNTIL the poor plumber comes to change the water heater and unknowingly interrupts the return path. It happens. Seen them tied to gas lines, too.

Date: Mon, 03 Jan 2000 00:38:25 -0800
From: eengineer <eengineer@erols.com>
Subject: Re: [R-390] ATTN: BA Owners! You might want to archive this

Norman, you are not belaboring it. One more gotcha - dont forget that your house AC outlets CAN be wired incorrectly, so even though your AC power cord to your radio is correct,
someone may have swaped the Hot and Netural lines in your house AC sockets. A cheap $3.50 tester available at any hardware store will quickly identify problem socket wiring to save your body/house/radio later on.

Date: Mon, 3 Jan 2000 09:25:30 -0500
From: km1h@juno.com
Subject: Re: [R-390] Fused Neutrals

The original part of my house was built in 1838. I bought the place in 1989 and went thru it completely plus built a large addition. You can imagine the various types of electrical wiring I found still hooked up. Fortunately the original parallel wires on ceramic insulators had been

disconnected! During the rebuild I discovered that the ground rod had been eaten away and all that remained was a 2' stub of rust in the ground. I quickly installed three 8' utility grade rods at 7' spacing. Due to the presence of solid ledge I had to angle them in; I'm not sure if it is sufficient or overkill. Moral of the story: Unless you installed it, dont take any grounding for granted. Some soils eat the copper plating in no time. In other soils you need to go to sectional rods and may not find an adequate ground for 20' or more. There have also been horror stories about aluminum ground wire which I understand was popular for a few years in the 70's.

Date: Mon, 3 Jan 2000 13:29:38 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Fused Neutrals

Actually, that old "knob-and-tube" wiring was better than what came later. If there was a short and the fuse didn't blow, the arcing stopped where the conductors separated far enough. The cable that had the "tar-and-rag" isulation in the black conduit or with the ungrounded flexible metal jacket is much worse! There, a short that doesn't blow the fuse will travel all the way back to the panel!!! And start fires all the way. This can happen if the bolts on the fuse holders and bus bars AREN'T TIGHT enough to pass sufficient current to blow the fuse.

> During the rebuild I discovered that the ground rod had been eaten away
> and all that remained was a 2' stub of rust in the <snip>

The code requires at least two rods at least 6' apart, BUT,..... The National Electrical Code is MINIMUM STANDARDS!!! Its not guaranteed to be efficient or to even work, says so in the front of the book! > Moral of the story: Unless you installed it, don't take any grounding for granted.+++++++++
Yup. Learn about it and understand it, I don't mind saying this here as we're all technically oriented and can handle complicated electrical subjects,..... aren't we? Some people shouldn't do their own wiring, it scares me.

>Some soils eat the copper plating in no time. In other soils you
> need to go to sectional rods and may not find an adequate ground for 20'
> or more. There have also been horror stories about
> aluminum ground wire which I understand was popular for a few years in
> the 70's.
++++++++++++++++++++++++

These days the code disallows aluminum closer than 18" to the ground or wet areas. I don't use aluminum AT ALL! (well, I can't get copper entrance

cable, but then I don't do many houses) If you have it on your service the torque should be checked yearly, it WILL loosen up, then heat up, then turn blue, then go POOF!

One or two R-390's on one circuit is Ok, but someone on another list wanted to put a transmitter on a 15 amp circuit, I'd say no there as the surge current on key-up may cause problems. Radio equipment should be grounded separately to take care of the RF problems, use BIG wire.

Date: Fri, 14 Jan 2000 07:05:15 -0600
From: "John P. Watkins" <jwatkin9@idt.net>
Subject: [R-390] Safety

Hi Jerry, can't agree more. The one that I have is an old one that I got from a friend that is a "good" electrician. It is wired so that the problems that you describe are caught. I found that the neutral and hot had been switched in 1/3 of the outlets in my house, and that the safety ground hadn't been connected in the garage. You can guess at what that could have caused. I was surprised at the problems because we had had a "professional" go over the house before we bought it. He most likely used one of the $3 checkers if he even looked. Still should have caught the no safety ground condition though. Just means that we have to check these things ourselves if we want to survive. Especially with our hobby being old tube type HV radios. I am now going to drive a few new grounding rods in near the garage and redo the system there. Should have done it long ago but time is always short. John WD5ENU

Date: Thu, 13 Jan 2000 21:59:19 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Line voltage monitor on the cheap

Beware of the $3 receptacle tester. It can't tell the difference between neutral and safety ground improperly connected together at the receptacle (thus making the radio case hot if the neutral breaks) and properly connected together at the main panel or swapped. It also can't tell the difference between a proper ground connection and an accidental one from shoving the ground wires back in the box. Only a good visual inspection will detect these common cheats. I've had the widows of the first case as clients on construction sites, and I've found the second on my own. Some old time electricians refuse to understand safety and cheat as much as they can to save a few pennies or minutes on a job, especially a house, more so in the country where inspection may not be great. Sometimes it costs them the price of the house, sometimes more.

Date: Fri, 14 Jan 2000 00:32:22 -0500
From: Barry Hauser <barry@hausernet.com>

Subject: Re: [R-390] Line voltage monitor on the cheap

Yup. They are handy for indicating the other screwups, but a double green or whatever OK pattern doesn't mean you're safe.

I had a situation in my office setting up a new computer on a proprietary 100 Base T network. As soon as I hooked up the computer with the R45 plug, the whole network went down. After much chasing false leads and gnashing of teeth, I used one of those testers which had earlier indicated good. Slight wiggle showed a missing ground -- worn socket. It made good contact on the hot and neutral, not the safety ground.

The thing is this -- the hot and neutral are tend to make contact even after a lot of wear. If they don't, you know immediately, because things don't work. Not so with the safety ground. In a way, the little $3 tester is better for this than a voltmeter. With a voltmeter, the tendency is to move the probe around until you get a reading, but that doesn't tell you that the ground pin isn't tight enough. If testing with a voltmeter, use an extension cord or outlet strip and take the readings off that while wiggling the plug in the wall.

Way back when, I had a temp job at Slater Electric putting together salesman's displays of theirs and five other brands of commecial/residential outlets with all the parts disassembled. As I recall, I wasn't impressed with any of them. Whenever possible, I glom up those special orange jobbies, although the orange signifies an independent line, (I think) but the quality is much better.

When moving into a new (old) place, it makes sense to open up every outlet and check them out. The receptacle quality may be poor -- there were some super-cheapies or they're worn or have become brittle and show signs of chipping/cracking. It becomes a bit dicey when you go to plug or unplug something and a hot outlet falls apart. Also, the dust builds up over time in the gem boxes. It may be dust bunny-like or very fine. Either way, it will serve as high effiency kindling in the event of arcing. So -- when you open them up to inspect, have a vacuum cleaner handy -- and some new outlets too. If you discover plastic gem boxes in your shack, you might want to replace with metal, too.

Traditionally, but unfortunately, the damn outlets seldom mount tight to the gem box AND stick out far enough to mesh with the cover plate. That's because too much of the sheetrock/drywall or plaster has crumbled away near the mounting lugs or the whole was cut to big to start with and the gem box is mounted too far back into the wall studs. So, the usual trick is to back off on the two mounting screws, then fiddle with the plate so that the outlet is pulled forward as you tighten the plate screw and held tight by

"dynamic tension". After a few pluggings and unpluggings, the outlet gets loose and pivots. That doesn't do the wiring any good and is especially bad news if you have aluminum wiring which you should yank out anyway. I think the idea is to shim the switch by the tabs to make sure it's good and solid.

Sorry to ramble on about this, but .... maybe it will help someone out. R-390's are pretty rugged, but don't hold up well to flashovers, backdrafts and 2,000 deg. F, not to mention bad grounds.

What's a crying shame is that, as Jerry points out (and I think Joe will agree, too) a lot of electricians have taken a lot of shortcuts -- and maybe the manufacturers as well. Here we have licensing, but it doesn't help much. I've tried to encourage electricians to go over my system in detail, practically inviting them to charge me an arm and a leg, but no one seems to have the patience to trace out an old system for PM. Then, again, yours may have also been "helped" along by a weekend hacker at some time.

Date: Fri, 14 Jan 2000 08:26:12 -0600
From: Dick Carroll <dixie@townsqr.com>
Subject: Re: [R-390] Line voltage monitor on the cheap

There is a high-grade outlet known as "hospital grade" which is designed to maintain very tight grip on the AC plug, and retain this grip over long periods of use. I stumbled across a new box of them at a yard sale, evidently left over from some contract job, bought them for near nothing and later learned what I had found. They are so tight that the line plug doesn't insert easily, is not that easy to remove and evidently are constructed somewhat differently than normal outlets. I replaced one in the kitchen that had worn out. I won't be needing to replace that one again. They ARE just a bit of nuisance to use especially when new (don't know how much this changes with time if it does), as insertion resistance is fairly high and you must sort of "force" the plug in all the way. But you won't have to worry about poor contact.

When we bought this house 30 years ago it was not quite finished as the contractor needed to move to another project, and I did the finish wiring myself. (I worked in the industry for a time as a young fellow). So I have had a ringside seat to wearing out AC outlets, and have replaced a number of them. Quality varies considerably, but the hospital grade units look to be good for the long haul. I'd imagine they are a special order item and a bit pricey.

Date: Fri, 14 Jan 2000 12:16:30 -0500
From: Christian Fandt <cfandt@netsync.net>

Subject: AC Outlets Was: Re: [R-390] Line voltage monitor on the cheap

The Commercial Grade outlets are very robust and should be very suitable for high use areas such as kitchens and our R390 workbenches (notice how I slipped this further into 'on-topicness'! :-) Hospital grade is indeed rather expensive compared to commercial grade (tho I haven't had to get quotes for them in years) and nearly impossible to find at any of the normal consumer stores. An electrical supply distributor who serves contractors and the healthcare industry *might* have them on the shelf if in an area which it serves the healthcare industry. There's only one distributor in my town of the several that I buy from who has hospital grade stock.

Commercial grade, OTOH, is usually found at Home Depot, Lowe's, etc and even some well stocked local hardware stores who serve contractors. Price is worth it for those heavy duty applications I feel. These are *very* much better than those 50 cent 'residential' grade outlets you can even find at department stores, supermarkets, etc. I bought comm. grade for the kitchen, laundry, garage and workshop and use the lo-cost ones for things like living room, bedrooms, attic and other lo-use locations (i.e., few times to plug-in/remove stuff).

Date: Fri, 14 Jan 2000 11:20:14 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Line voltage monitor on the cheap

One place I rented (in Allen, Texas) had all three wire receptacles, but when I went around with the tester, only one was grounded. So I used that room for ham shack. Sometime later I had the cover off that outlet and found the ground was accidental. There was a ground wire in the romex, but the two ground wires (romex in and romex out) were cut short, lightly twisted together, and pushed back in the metal box. In that one box the ground wires accidentally touched the metal box. I had a devil of a time pig tailing the short grounds to get a wire to the receptacle.

When I go to test a grounded outlet where there's been a serious injury or death, I take a modified outlet strip. In that strip I've replaced one of the receptacles with one having an isolated ground. On that isolated ground receptacle I've swapped neutral and ground. I connect my voltmeter from neutral to ground. Then I plug a 1450 watt space heater in the normal receptacle and measure the voltage drop of the neutral wire. Then I plug that space heater to put the return current through the safety ground and check the voltage drop again. If the ground was accidental its 120 volts... If the wiring is fairly old with a smaller safety ground than neutral I can detect that. That much current burns off accidental grounds.

I have an appliance/tool tester that runs through a sequence of checks on a portable tool and it checks the safety ground wire with 30 or 40 amps to be sure the ground connections are solid.

In my WESCO catalog a few years old, residential grade duplex receptacles run as low as 46 cents each in ten lots. Hospital grade receptacles list from $12 to $24 each, sold for $10 to $20 each in ten lots.

When my dad built and wired his house in the late 40s he thought he put in quality receptacles, but I've had to replace many for him in the past few years because plugs would fall out. Few receptacles are made with excess metal anywhere. A 0.1 penny saved on each can make for a few million extra profit each year.

Orange signifies the ground isolated from the box. So it has to be wired on purpose. The code application is for computer circuits where the ground is only grounded at the main panel, not interconnected to the conduit and to other receptacles anywhere else.

I don't believe in depending on box, conduit, or screws for the grounding circuit though the NEC allows for that. In my opinion there must always be a copper wire from main panel ground bar to each receptacle ground screw. And that safety ground wire should be no smaller than the phase wire. This construction minimizes having high resistance accidental grounds that may affect my comfort some day when an appliance fails with a short from the hot wire to the metal case.

Date: Fri, 14 Jan 2000 11:33:14 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Line voltage monitor on the cheap

The 100 watt light bulb and two wires is a better tester of grounds than the neon bulb fancy tester, at least it puts nearly an amp down the ground to detect accidental connections, but I prefer to put more or to visually inspect.

Date: Fri, 14 Jan 2000 13:52:36 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Line voltage monitor on the cheap

But the NEC accepts conduit with all its intermetallic connections to be the sole safety ground conductor. I don't want to bet my life or my assets on that.

Date: Fri, 14 Jan 2000 14:11:24 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>

Subject: Re: [R-390] Line voltage monitor on the cheap

Right! But the code is MINIMUM STANDARDS. If that's good enough for anyone, its not for me. Its the cheapest that it can be done for, but then again, that's IF it actually got inspected, a lot of it doesn't! That's also if the inspector knew what he was looking for. Inspectors don't have to have any electrical construction experience or degrees to get their jobs. Its a political appointment. He just has to know how to read the book. I've had some that had to be shown what they were looking for. Most are confused by explosion proof (hazardous location) wiring.

Date: Wed, 19 Jan 2000 11:59:32 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] GFI Problems

<snip> Some further observations:

In aviation safety, where failures are often very dramatic, accidents are very often caused by a combination of conditions and events, each of which is quite unlikely and which occur in disastrous combinations VERY infrequently. I suggest we all consider combinations of the following events/conditions as we figure out what to do about our R-390A with the 60
volt chassis:

- The "station ground" which we so carefully install and maintain at our operating desk is not present on the test/repair bench or table.

- The white and black wires got mixed up somehow.

- The three wire line cord we used had some strange colors from Europe and we got them wrong.

- There actually occurs a leak or failure in a capacitor in the line filter one day. These things are now from 25 to 45 years old.

- That "licensed electrician" that did the wiring in the basement for the house's previous owner was incompetent, lazy, or just made a mistake. (Outlet testers cost less than $5. Do you have one that you use a lot?)

- The ground connection on that outlet strip you have been using for some years now is not too tight and fails to make good connection SOMEtimes. (This happened to me recently. The
R-390a BIT me!)

- You use one of those oval-ended line cords meant for business machines

and found on early HP test equipment, but you happen to get one which is wired in an odd configuration and you get the line and neutral mixed up.

- HEAVEN FORBID you actually try to use a FUSED LINE CORD, not knowing the many, many ways it can kill you. (I bought one at a fest last weekend, mostly to keep it out of the hands of someone who wants to put it back on his Ranger or Valiant and either does or does not know what he is doing.)
Roy Morgan

Date: Wed, 19 Jan 2000 08:25 -0800 (PST)
From: rlruszkowski@west.raytheon.com
Subject: Re:[R-390] GFI Problems

I never understood why it was done the way it was but. Yes R390 and R390/A will trip GFI's because there is a current flow on the ground chassis. If your R390 is not grounded, you will get a nasty little jolt when you insert yourself into the ground path. That current is enough to get you and it will upset a good GFI breaker as it well should.

The problem is in the selenium rectifier and the antenna relay circuit. The damn thing is actually designed and works that way. One of the first things we learned in school was to make sure we had the chassis grounded. The first thing we learned in the field was how to get the scotch tape applied to the rack rails and screw heads to isolate some nugs receiver. There should be a solid state mod to replace the selenium rectifier with silicon diodes and at least get the current off the chassis. Hopefully some one will remind us where its posted. Rick Mish rebuild is good. He left it just like it was designed and built. This was OK until GFI breakers were introduced. As you pointed out they work OK on a not GFI circuit as expected. If you have your GFI breakers in the shack area, you do want to defeat them by putting a hard ground on the receivers that by pass the GFI breaker. The receiver ground would then become the return path for any fault on the same circuit as the receiver. Maybe we need to visit this whole issue again. We do want to do hard robust short grounds from the antenna, receivers, and transmitters in the shack. However we do not want to upset the safety of GFI breakers. One approach would be isolation transformers.

Mike I think you touched on a bigger issue here than just your receivers tripping off the GFIs.

Roger KC6TRU San Diego

Date: Wed, 19 Jan 2000 12:27:57 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] GFI Problems

Two capacitors from line to chassis and from chassis to neutral act as a voltage divider. Unless there's some other significant C to ground (the radio itself will only account for a few hundred pf) those two act as a voltage divider and give the 60 volts. When you ground that chassis through you (maybe 1K) you get a current of 4 ma, just about the threshold of feeling and above the trigger current for a GFI. All radios before GFI tended to use capacitors from line to chassis and chassis to neutral. More often .05mA but still enough to tickle when the radio wasn't grounded.

There are low ground current line filters these days, made with more emphasis on series inductance to make the smaller capacitors more effective. A large capacitor across a noise source of very low impedance (and the AC power line impedance is nearly as low as a large storage battery) has little effect, while if there's a series impedance to the power supply the capacitor can have a great effect without being large.

E.g. going to capacitors alone may reduce the ground current, but at a great sacrifice of acceptance of unwanted signals through the power line.

Date: Wed, 19 Jan 2000 12:33:04 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] GFI Problems

You say that the relay circuit is AC/DC running directly from the AC line and returning the current to ground? Changing to silicon won't help that though it can help prevent filling the work space with fumes from a failing selenium. There is not good reason for a relay circuit returning to ground and power directly from the AC line. A solid ground will supply a return path for fault current. That's inherent in the GFI circuit, but WILL NOT prevent the GFI from triggering on bypass capacitor current. The GFI compares line to neutral current and they aren't the same it trips. It trips better with a solid ground on the radio.

Date: Wed, 19 Jan 2000 14:37:12 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] GFI Problems

..... "all radios before GFI tended to use capacitors..." puzzles me, though. Didn't the chassis on these radios have the same problem of being hot wrt ground?.....

Every last one of them would bite the user if the user found a ground and

didn't have a ground on the radio. They came with two wire cords (I'm speaking of radios in the 50s and 60s), none polarized plugs and had a bolt sticking out of the back for the radio system grounding. Some may have used smaller capacitors to lessen the bite but it was there. None used high quality high voltage capacitors or capacitors rated for line applications (because that rating hadn't been invented yet). And those capacitors across the line often weren't as high a quality as black beauties so sometimes there was a lot more bite than just annoying! It upsets the natives to see sparks when connecting the PL-259!!!!

> And if I understand it properly, you can run these radios on a 3-wire to a
> properly grounded, non-GFI receptacle and the chassis will then be >
safe?

Providing that outlet is properly grounded and some lout too lazy to turn the plug over doesn't pull the ground pin out of the plug.

> Is it because there isn't enough current through the caps to be a problem?

It is because whatever the current, until the capacitor on the hot side gets really leaky (R < 12 ohms), the ground and the supply fuse or breaker will carry the leakage current. And the ground resistance is substantially lower than that leakage resistance. THAT IS WHAT THE GROUND WIRE IN THE POWER CORD IS PRESENT TO DO. THAT'S ITS JOB, to divert leakage and fault currents from the user of the apparatus. Nothing more, nothing less.
----------9----------
Date: Wed, 19 Jan 2000 18:28:17 -0500
From: Glenn Little <glittle@awod.com>
Subject: Re: [R-390] GFI Problems

This is also a factor for shipboard operation. Each leg of a 110 VAC line reads 60 Volts to hull (ground). In a damaged situation where a short occurs from one leg of the AC to ground (remember this is like the neutral in your house) the equipment is still operational. It still sees 110VAC leg to leg as both legs were originally above ground.

For normal shipboard conditions, the electrician routinely does "Ground isolation" of the AC busses. In Maneuvering or EOS on the targets, the on watch electrician can measure ground resistance. This is used to establish that there is a distribution problem (leakage from one leg to ground). This allows the isolation of a piece of failing equipment before the equipment becomes completely inoperable. The failure where there is a completely shorted led to ground occurs during flooding or cable damage problems. Hope this lends a little insight as to why the condition within the R390* exists.

Date: Wed, 19 Jan 2000 18:57:02 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] GFI Problems

Once when I was at Collins in Cedar Rapids we had a gadget that monitored the 120 volt AC line for spikes. In the factory, there were several 1 KV or better spikes an hour. A cap without that withstand capability would be damaged rapidly.

Date: Thu, 20 Jan 2000 12:07:31 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] GFI and voltage And when I am wrong I am wrong.

The current is reactive, not resistive, so doesn't accumulate on the residential watt-hour meter. I compute it to be in the 4 milliamp range with the chassis grounded. The line noise filter is on the line side of the fuse and switch, so that current is always there, and if the chassis isn't grounded that tickle is always there. If your cat marks the radio while its not grounded and he's on a metal bench top that is grounded, he won't mark the radio again!

Date: Thu, 20 Jan 2000 08:09 -0800 (PST)
From: rlruszkowski@west.raytheon.com
Subject: [R-390] GFI and voltage And when I am wrong I am wrong.

Go see the thread on the input filter caps passing AC from the hot side of the line to the chassis. I pulled the main fuse on the back panel right after the filter on year 62 model. I pulled the power supply connector. Then I plugged the receiver into a two prong plug up on the bench and no ground. One way I got 60 volts AC the other way was about 30 volts AC. I thought of all our receivers being plugged in and turned off while sucking power to ground. I was unable to measure the current with my in line AC 10 amp meter. Not even a meter wiggle. So its not a lot. This is the correct answer. I did look at the rectifier and antenna relay. I was wrong there is no voltage leak in that circuit. So much for that pro pay question.

Date: Thu, 02 Mar 2000 06:48:49
From: Glenn Little <glittle@awod.com>
Subject: Re: [R-390] AC Power Line filtering.

> Also, I have a very good station ground
>> (for the locale) consisting of 5 ground rods. Do I want to tie the filter to
>> this ground or should I tie it to the "green wire" ground. Station
>> ground strip is about 3 feet from where the filter will be located.

If you are looking for a safety ground, the "green wire" ground is good.

However if you are looking for a lightning ground, you MUST keet the length of wire from the suppressor to actual ground rod in the ground to less than five feet. Any thing much longer than this and you wasted your time and money installing a lightning protection device. The lightning strike is HF. The inductance of the ground wire is significant. UL1449 does not require a specified ground length for testing to get the UL rating. So the mfgrs test with zero ground length to get the best suppression rating. Look at the specs on one of these UL1449 rated devices. They suppress at 330VAC for the most part. With five feet of ground wire, this goes to over 700 VAC. Can the input of your equipment survive this??? Also gor a lightning ground the ground wire MUST be as straignt as possible with the MINIMUM bend radius of eight inches. Braid will NOT work and is expressly forbidden in installations that go by the Motorola R-56 standard for site selection/protection and MIL-HDBK-419 for impulse survability. Number 6 wire either stranded or solid is used inside with number zero used outside for the ground ring to bring all of the ground rods to a single point ground.

Date: Sun, 30 Apr 2000 09:42:05 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Re: [Antennas] Ground Question

Yes the outlet tester will show gross errors. There isn't one for 240 volt outlets. It won't show up the accidental connections in the ground circuit that I've found. Modern 240 volt appliance circuits now use a 4 wire cable and 4 wire receptacle and plug to separate neutral from ground and so enhance the user safety of the appliance. I to have seen such 240 volt circuits permuted so that in a school the ceramic kiln case was 120 volts from the grounded adjacent sink. That particular permutation also kept the kiln from heating to full temperature which is why I was there.

The Jones stands weather OK, but it isn't perfect. Gold pins would be far better, especially in the meter circuit.

Three ground rods in close proximity (less than a rod length apart) are not significantly more effective than a single rod because of the relatively poor conductivity of the earth.

When there's a conductor going through the waveguide, its wide band coax, NOT a waveguide beyond cutoff and so I don't see it as a deterrent to lightning. The use of IRON conduit, may cause some retardation of the rapid lightning currents due to induction and eddy current losses. E.g. it might act somewhat as a "current" balun or a decoupling sleeve. But it sure isn't waveguide beyond cutoff. Wishful thinking destroyed by the conductor in the pipe.

Its clear the NEC was not written or updated by RF, lightning, or digital literate people. I sometimes wonder about the AC literacy of some sections. It is a whole lot better than having 3200 county codes each written by a county council that collectively couldn't fix a flashlight reliably. Its purpose is not RF grounding, digital data common mode loop prevention, or lightning protection. It sometimes allows for considering those problems separately.

Date: Sun, 30 Apr 2000 12:28:06 -0400
From: "Gregory W. Moore" <gwmoore@moorefelines.com>
Subject: Re: [R-390] Re: [Antennas] Ground Question

I can't tell you the number of times that I have seen the "hot neutral". Remember, that the main power drop is connected to the electric supplier input with "bugs" (split bolts with an insert that clamp the drop and the supplier input together) or by crimp connectors. They are more often than not, poorly done, and buried under a mass of dubious insulation. At best, they are rather high resistance. Depending on the number of drops connected to the supplier input, which may or may have a good external ground (used to be to the cold water pipe, which again may or may not be bonded all the way) and the distance to the ground at the transformer, a substantial voltage can be seen between the neutral and the actual ground sink. I have seen one memorable instance where the entire neutral/ground had become so coroded that the ground return had been taken over by the shield of the cable TV input coax to the house. the coax had actually heated to the point where the jacket was melted and the dielectric was "soup" between the center conductor and the ground sheath. The amazing thing, is that everything in the house (except the cable tv) still worked fine, the coax was red hot though :-)

Date: Sun, 30 Apr 2000 23:05:49 -0700
From: Dick Carroll <dixie@townsqr.com>
Subject: Re: [R-390] Re: [Antennas] Ground Question

Gregory W. Moore wrote:
>
> I can't tell you the number of times that I have seen the "hot neutral".

Then you've probably seen an open neutral, and the crazy effects it can cause on a 120 VAC system when the "common return" is lost. I once walked onto the shack at a really remote repeater site in response to a failure report and flipped on the light switch. The bare bulb in the ceiling responed with a dull glow that sorta Sloooowly modulated, and the constant voltage transformer that fed the repeater actually moaned. There was also a remote base station located there on another service, and it was really sick. I immediately recognized the symptoms of an open AC neutral,

and started visually checking the neutral for a break. Finding nothing abnormal in the building, I began to track the AC feeder back to the pole transformer which was located about 200 yards off in the woods. There I found that a mobile brushcutter, clearing the highline right-of-way, one of those rigs on an long extended arm, had somehow hooked the neutral wire coming from the transformer and it hung loose in plain sight. If the crew even noticed they didn't bother to report it. The repeater suffered no damage but that remote base was really trashed. It was hauled away and was later replaced.

Thinking about it, when the neutral opens on a standard 120-0-120 system, it leaves a luck-of-the-draw hodgepodge of variable current loading series-parallel 120VAC devices across the 240VAC line, and the results can be wild, depending on just how your unit happens to draw in the series-parallel poker sweeps. Maybe your input voltage will be 60 volts or maybe 180. Nothing can be planned for. You takes what you gets. It can be a ho-hum that works fine when the neutral and normalcy is restored, or it can be a wipeout.

The other time I saw an open neutral on a repeater site was an outdoor repeater mounted on a pole next to a steel fire tower with the antenna mounted on top of the fire tower. Arriving at the site all seemed normal until I keyed the transmitter, then things fell quickly into the toilet. Immediately I realized that the supply voltage had seriously dropped under transmitter load. Probing with the Simpson 260 showed a whopping 60 VAC under transmitter keyup, with 113vac unkeyed. Again, symptoms of an open neutral, which I soon spied up on the AC supply pole. This time, evidently the victim of age and wind action which over the years had just worked the bare wire until it separated. Best I could tell the system was getting its neutral via the coax shield which went 100 feet to the antenna mount at the top of the fire tower, through the OLD undoubtedly rusted mounting hardware then back down the steel tower legs to its ground then through the earth to the power pole ground wire. LOTS of series resistance which showed up as very excessive AC voltage drop when it was loaded. Considering the quality of many neutral connections as you mentioned its a wonder we don't see more of this sort of thing.

Date: Sat, 13 May 2000 21:31:08 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] wondering

A lamp in series with any electrical device being tested has been standard operating procedure ever since lamps became reasonably priced. That probably was enhanced by some -Edison companies that gave out free light bulbs to their customers for many years. Nothing better for test equipment than a free lamp!

Date: Sat, 30 Dec 2000 10:40:08 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] R-390A Newbie Questions

The bypass capacitors in the line filter, even if not leaky (and there's nothing about their age to say they aren't leaky like the rest of the paper capacitors in the radio), will draw enough current to ground to trip the GFCI. You can run a special circuit without GFCI and ground the radio securely and have equivalent safety, providing the ground is maintained. Or you can replace the line filter with one from a computer power supply that is designed with smaller capacitors and better inductors to be more effective. <snip>

Date: Sat, 30 Dec 2000 10:40:11 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] R-390A Newbie Questions

Switching the neutral in the radio is considered unsafe because while it stops the radio from functioning, it leaves the line wires hot with respect to ground so continues to stress the component insulation and the repairer's fingers when they contact that live but "cold" circuit. Then the repairer's fingers receive further stress and damage as they break components on their way out propelled by the involuntary muscular contraction brought on by electric shock. Then there's the possibility of the bloody residue leading to corrosion of the radio and excess current leakage. To say nothing of the blood spilling from the split fingers and the language unfit for the kid's ears. And the damage to the radio from rolling over and falling off the bench. E.g. switching the neutral works but leads to unhealthy side effects.

Date: Sun, 31 Dec 2000 12:06:53 +0200
From: "Paul Galpin" <galpinp@sabc.co.za>
Subject: RE: [R-390] R-390A Newbie Questions

<snip>
2. Earth Leakage

Silly me - I had forgotten that the 390, otherwise a superbly crafted piece of engineering, only switches one line! but my experience (repeated only a few days ago with Christmas tree lights!) is that I actually hear the Earth Leakage tripping the house out _before_ I feel the 220V tickle, and a tickle is all it is, so surely 120 going down to 90 volts can't harm you? You could go into the transformer connections, and re-organise them so that the end of the winding with the most earth leakage gets connected to the Neutral feed. Anything to avoid buying a new transformer! Then again it could be

the filter C's.

Try reversing Line and Neutral temporarily. If it makes a difference, that could be a pointer to the fault.

A really sensible thing would be to have the bench supply with its own GFI, and it would keep the wife happier too!

BTW, GFIs are mandatory for all domestic housing here, and a damn good idea too! Also, no fuses to be replaced with a six-inch nail, only current overload breakers. Is there a US standard for these things, or does it vary from State to State?

Date: Sun, 31 Dec 2000 12:23:32 -0500
From: "Wm. L. Townsend" <wlt@tesnet.com>
Subject: Re: [R-390] R-390A Newbie Questions

<snip> 2. Earth Leakage

The reason that R390As tend to trip GFIs is that the GFI looks at the difference between the line and neutral currents to detect a fault. If you look at the schematic of the line filter used on the R390A you will see that it has capacitors from line to ground and neutral to ground. The current flow in the capacitor from line to ground causes enough unbalance relative to the current in the neutral lead to trip most GFIs. (Since the neutral is nominally at ground potential there's much less current flow in the capacitor on that side.)

The only easy solution I've ever seen is to use a different line filter or to run the radio on an isolation transformer. You could also disconnect the line filter but that might cause other problems.

Date: Mon, 01 Jan 2001 13:24:07 -0500
From: Jim Miller <jmille77@bellsouth.net>
Subject: Re: [R-390] GFI protection - need help please

Yes it is the R-390A that trips the GFI, and it apparently is "normal" for this to happen. It happens with my R-390 also. From all I've read, I believe the best solution would be a line isolation transformer between the radio and AC line. But I also believe the chassis should be grounded for safety. The filter is in a small enclosed metal box just behind the AC line connection on the back of the receiver. But I do not wish to remove or open mine.

Date: Mon, 01 Jan 2001 13:23:48 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>

Subject: Re: [R-390] GFI protection - need help please

The line filter is before the line switch. The capacitors are large enough that they will pass enough AC current to ground to trip an American GFCI even if not leaky. At age 30+ they are presumed leaky and that leakage may be temperature sensitive. In fact, the leakage may increase with time as it heats the line bypass capacitors. With antenna and power ground disconnected you will find the radio chassis floating at half line voltage (providing one side of the line is grounded, USA style). The R-390 will naturally run from your 115 volt output isolation transformer, though the power transformer primary will need rewiring.

There are effective filters made these days for the line of computer power supplies that don't draw so much current to ground. The works of one of those could be installed in the case for your 390 filter. Take coils and capacitors.

Date: Mon, 01 Jan 2001 15:03:22 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] GFI protection - need help please

BINGO!! (Was it you to whom I sent the 50 cycle SOLA transformer a year or so ago???.. if so that is IDEAL, if not, your 220 to 115 volt isolation transformer is nearly as good.) Run your R-390A on 115 volts. Just move the switch on the power supply and run it on 115 volts. Your troubles and your worries will disappear.

... Someone wrote
>also to disconnect the line filter, but these may cause other problems.
Which problems can this be ?

The filter is meant to prevent signals from high power transmitters from getting into the receiver and interfering with reception. You do not have that problem, I bet.

>Or could it be that the capacitor from line to ground (please tell me
>where I can find it in the rig -- in the line filter I think) is not ok?

Yes, it is possible that the capacitors in the line filter are heating up slowly due to leakage and getting more leaky over time.

>Is the line filter named FL-101 with C104-C107 and L101-102 ?

Yes. The capacitors are inside the sealed unit. They are also potted in insulating compound. Taking the thing apart is a big job.

Date: Tue, 2 Jan 2001 07:54:21 EST
From: G4GJL@aol.com
Subject: Re: [R-390] Inrush Current Limiters

This modification should be mandatory for membership of this list! I do it on all my boatanchors, and test equipment too. Silicon rectifiers or not. Definitely worth while.

For the more money conscious amongst the group, a good place to find these thermistors for free is in the mains input circuitry of scrapped computer switched mode power supplies. I never let one be thrown out without first removing them, and often certain other components for BA projects. Test them before you install them, though!

Date: Tue, 02 Jan 2001 10:55:00 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] R-390A Newbie Questions

What are the current limits for that GFCI? Ours (USA) is below the threshold of feeling in humans. A couple milliamps. There is also an industrial main panel GFI to shut down at a few amps to protect (generally 480 volt three phase) systems from lingering arcs that may prevent a fire, but won't protect people.

Remember the currents for people: About 5 ma is the threshold of feeling, 25 ma the maximum for muscle control, e.g. the limit "let go" current, 50 ma for ventricular fibrillation, 200 or 250 ma for heart stop and larger currents tend to cause considerable deep burn damage. So a 100 ma GFCI may protect the wiring and the building, it doesn't protect the occupants from shock the way the USA GFCI does. So the USA requirement (reached by consensus of many) is limited to areas where one might find a ground such as bare dirt, damp concrete, or metal plumbing.

Date: Thu, 04 Jan 2001 11:03:09 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] R-390A Newbie Questions

Yes, our services are what you term as two phase, 120-0-120. Residential anyway. That way there's a lower voltage to ground. When you get up in the 240/416 three phase you are in a region where arcing faults tend to not clear from burning material away. 120 volt arcs tend to be self extinguishing because once there's any gap at all (they have to be started by contact) the ionization generally clears rapidly while the voltage is low at zero crossings. At 240 and 416, that's not true, the rate of voltage rise at zero crossings is more rapid than the rate of ionization clearing so that arcs tend to persist. Worse, there is enough impedance at that voltage that

the arc current is not sufficient to trip circuit breakers or fuses so GFI are important distribution and residential protection. Your loads are never connected to earth, only line to line.

Our most common loads are connected line to neutral and a separate safety ground is carried throughout the system and buildings. Neutral and safety ground are connected together at the main entrance panel in each building (unless its served from another building on the same meter). The power distribution transformers typically handle a few houses each, with power ratings under 100 KVA with primary voltages varying from 2400/4160 (being rapidly replaced by higher voltages) to 14.4 KV/21 KV three phase Y connected. Most commonly the distribution voltages are Y connected 7200/10,200 volts three phase. There are some problems with this scheme, being 7200 volts to ground with often bare wires only about 20' above the ground in residential areas, which leads to problems of antennas falling, kite strings, balanced poles, grain augers and the like easily reaching them and causing severe injuries.

Farm and industrial service can be either from a two phase transformer bank where and open Y primary and open delta secondary gives three wires plus neutral, or most commonly 120/208 three phase Y secondary. Heavier industry uses 277/480 three phase Y secondary.

The open delta secondary has neutral at the middle of one side to give 120-0-120 and then a "wild leg" about 186 volts to earth. There is generally 240 volts from one 120 volt wire to the wild leg wire supplied by a transformer and then approximately the same from the other 120 volt wire, but that voltage varies with load and is the wild phase. This connection gives motors unbalanced source impedances and can lead to destructively unbalanced three phase line currents.

There used to be (and still are some industrial) systems running 480 volts delta connected with no neutral. The theory being that they can continue to operate with a ground fault on one phase. The failure in that theory is that they rarely notice and find that one ground fault until the second one occurs and takes the entire plant power system down. There also used to be 2400 and 7200 volt delta connected over head distribution systems. They had the same problems and nearly all have been rewired to Y connected systems with grounded neutrals (which also gives the distribution system greater power capability with the same conductor sizes).

Most of our distribution conductors are aluminum, but if there weren't a lot of transformers, there would be unreasonable amounts of aluminum or copper required.

When measuring AC voltages, especially at heaters one needs to be sure of

the calibration of the meter and the effect of distorted wave forms on that reading. Transformer secondary wave forms may be distorted by the rectifier load on the high voltage winding. Many common meters are peak reading calibrated in RMS which assumes a perfect sine wave. Some of the better DVM actually do a true RMS calculation in analog techniques.

I think the 390 would be served better by most meters to measure and set the input line voltage to about 115 to 117 volts and let the heaters run as they are.

Date: Sat, 06 Jan 2001 00:34:35 +0100
From: Kurt Brandstetter <kurt.brandstetter@teleweb.at>
Subject: [R-390] GFI problems ! MANY THANKS for help !!

Today I disconnected the line filter and bypassed it, as I use a line filter (a professional one) in the connection to all my rceivers. I tried to switch on and off the receiver (which receiver switched on, where before bypassing the GFI tripped every time) and also with switched off receiver where the GFI tripped some hours after operation up to 2 days later) and the problem never occured again. Not a modern cheap one in use for computers, its a high performance filter made by Schaffner company in Switzerland. I got it new AND cheap on a flea market for 7 $ US 1 year ago. Price new is about 200 $ US. If you are interested, the homepage of this company is: http://www.schaffner.com/ the name of the filter FN 352Z -10 multi stage filter. Search on the page search engine (search entire site) for fn352. You find the schematics and other very clear info ! The only work I have to do with my R-390A/URR is to change the "killer" capacitor (C553 ,01 mf if I recall correctly) ahead of the mechanical filters. I'll use the WIMA capacitor rated for 630 V and cheap and easy to purchase here in Austria. I think nothing speaks against that or ???

Date: Wed, 10 Jan 2001 22:44:31 -0500
From: Gene Beckwith <jtone@sssnet.com>
Subject: Re: [R-390] We Don't Need No Stinkin' Ballast Tubes

<snip> Regarding line voltage...have consistantly measured 119 to 121 volts here...have tamed it down to nominal 115 with some neat Hamfest souced Variacs... Costs are running in range of 15 to 25 bucks for eight amp to 15 and 18 amp jobs in various states of cosmetic conditions.... just panel mounted an 15 amp beauty that needed the critters kicked out on the street and a quick paint job... cost was 15 bucks at the Massillon, Ohio fall hamfest and auction... it's worth the effort and fun to do the softstart knowing your doing your best to protect your "Big Iron" Further to costs, check the lastest Radio Shack catalogs for a glimpse of reality regarding Variac type xformers...an 9 amp job is going for about 180 dollars....now that's serious...I picked up an 'identical one' at the Massillon fest for 10

bucks...needed some 409 and WD-40 to and a couple of evictin notices to the resident spiders, but the unit is in good contion and already doing service at W8KXR as a 'softstarter'... Finally, check under the benches and in the musty boxes for those heavy duty rugidized military AC line meters...You paid for them once, so why not pick 'em up and put them to use in your operatating area to adjust your line volts to the R-390X's?

Date: Fri, 16 Feb 2001 06:01:39 -0500
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] R-390A Audio into Computer and grounding

I had a bad experience with my R-390A and computers. The R-390A was connected to a printer, copying UP photos. The ground came off the RX and the chassis AC on the ground loop fried the printer electronics. It is a good idea to isolate the R-390A from modern electronics.

Date: Fri, 16 Feb 2001 06:48:03 EST
From: G4GJL@aol.com
Subject: Re: [R-390] R-390A Audio into Computer and Grounding

It's an even better idea to ground everything.

Do not use coax or audio cables as safety ground. Use three conductor power cables and tie the ground wire to the equipment chassis using a closed eye tag so it cannot fall off. Ensure your earthing system on the distribution side house wiring is effective. I found THAT out the hard way. The house was fine, but the power earth was non-existent in the shack. Now the shack has its own dedicated power earth spike.

Date: Fri, 16 Feb 2001 11:53:49 -0600
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] R-390A Audio into Computer and Grounding

You list some important things to do:

1) Do not use coax or audio cables as safety ground.

2) Use three conductor power cables and tie the ground wire to the equipment chassis using a closed eye tag so it cannot fall off.

3) Ensure your earthing system on the distribution side house wiring is effective.

This can be difficult to do. A good start is to get a small outlet tester and test each and every wall outlet you have. These test for proper connection of the wires, they do NOT test for current carrying capacity of any

connection including the safety ground.

> I found THAT out the hard way. The house was fine, but the power earth
> was none existant in the shack. Now the shack has its own dedicated
power earth spike.

Here you may be making some assumptions that will get you into trouble. I have read recently that an eight foot ground rod driven completely into average soil has a resistance of about 10 to 20 ohms. This is NOT a good ground. In the summer, the ground can dry out and the resistance goes up (at least in many places in the US.) Ground resistivity varies greatly from place to place. Do not confuse RF grounds for use with transmitting antennas and power safety grounds used to protect against failures in the line current supply of equipment and lightening grounds used to divert lightening induced currents.. they are all different.

I suggest the following:

1) Do not count on ground rods for anything but RF grounding, and even then be very suspicious of their performance. (Also, remember that a quarter wave of wire is an open circuit!)

2) Do not count on anything other than properly installed electrical wiring safety grounding to protect against power faults in the equipment (or in the house wiring).

3) Do not count on anything other than complete disconnection to protect your equipment against direct or nearby lightening strikes. This is a whole specialty field, and there is a LOT to know before you should count on anything you can afford and install to really protect your equipment. The Polyphaser company publishes a book to help you get started. http://www.polyphaser.com/

With respect to the "dedicated power earth spike" mentioned above, I suggest an experiment: Disconnect all equipment from the spike and connect a 150 watt lamp between the spike and the hot side of the power line. (I am assuming 120 volt system, to get about one ampere of current.) Measure the voltage between the spike and a cold water pipe, or power safety ground. Report the results to us.

Date: Fri, 16 Feb 2001 18:19:03 -0500
From: Thomas W Leiper <twleiper@juno.com>
Subject: [R-390] Re: Grounded in reality

The purpose of the power ground is to trip overcurrent protectors such as fuses and circuit breakers in the event of a fault, thus eliminating the

source of juice which could tan your hide. All fault currents have to travel back to the service panel via either neutral or the ground path, so both of these paths have to be good enough to trip the breaker or blow the fuse. Unless you are a utility, you should NEVER consider an earth path a ground fault path for the purpose trip overcurrent protection, but simply additional protection to humans because it ATTEMPTS to bring exposed equipment to earth potential. Example:

You have a "shack" out in the back yard where you play with radios and hide from the wife and kids. You run and extension cord out to power the place, and it is a "two wire" line which has "hot" and "neutral" identified (polarized), but no ground conductor. In the event of a fault condition such as a "short circuit" in a radio such as a primary winding in the power transformer, you would not be exposed to dangerous potential because voltage is not applied to anything you can touch, and the breaker would be tripped by the current flow from hot to neutral. If the "short" was from hot to chassis, and the neutral was bound to the chassis, the breaker would still blow as before, but the chassis would have 60V potential to earth because the extension cord, in effect, becomes a resistive divider with the "hot" run being R1 and the "neutral" run being R2. This is where people start to get into trouble... because they think that all they have to do is "ground" the equipment and they will be fine.

While such a ground WOULD reduce the chassis potential to ground locally, it would also ASSURE that improper currents would be flowing at all times during NORMAL operation since the earth return path to the service and the neutral would present a parallel circuit. So, only ground the chassis when you are sure there is no return path for normal current other than neutral. What usually happens is you find older wiring without ground where somebody puts in a grounded outlet and ties the ground lug to the neutral. This would be CORRECT (if the only available solution) and it would NOT be correct to tie an an additional earth ground here. You COULD have just the earth ground on the ground lug, but it would not offer fault current protection, and it would not really lower the risk of shock because, though the earth ground might reduce the potential to ground in a chassis short, failure to trip the overload protection would result in the dangerous condition remaining undetected.

But let's say you "upgrade" by running some 8/3 UF cable out to your shack from a 60 amp two-pole breaker, and you install a service panel so you can fire up your home-brew 10KW 240V spark gap transmitter and a spare compressor or two. You've played with the main panel in the house, so you ought to be able to handle this little panel install easily. What many do is bond the ground to neutral just like the main panel. This may or not be correct:

1. If the panel is a sub-panel within the same building, the neutral must be isolated from the equipment ground, and the equipment ground must have a solid path to the service equipment. This means that your neutral wires must go to the neutral buss and the ground wires to an APPROVED equipment ground buss attached to the enclosure. Any bonding strap or screw that ties the neutral buss to the enclosure must be removed.

2. If the panel is in another building, such as your shack, it is treated as service equipment and the neutral is bonded to ground at the panel along with a suitable earth ground. You would NOT, in this second instance, have a solid ADDITIONAL ground path to the main service (such as a 12% rule fourth conductor that may be in your 8/3 cable) as this WOULD result in improper currents.

This is not really very complicated if you keep in mind what the real purpose of overcurrent protective devices is, and make sure that both normal and fault currents travel along appropriate paths. Now, based on this lesson, who can describe the proper connection options for a single phase generator, and do you know what the term "separately derived" means...

Date: Sat, 17 Feb 2001 08:50:30 -0800 (PST)
From: a b <c18cont@yahoo.com>
Subject: [R-390] hot side, is it?

Helloo, again, right now::: I just realized,I don't know; What is the hot side, wide blade or narrow blade on the plug???

Date: Sat, 17 Feb 2001 18:03:47 -0000
From: "Michael P. Olbrisch" <kd9kc@elp.rr.com>
Subject: RE: [R-390] hot side, is it?

There are VERY SPECIFIC guidelines for electrical hook-up. It can be deadly if done wrong. The most dangerous voltage in your home is 120 VAC. It is not that there are not greater dangers. But most people tend to dismiss 120 VAC, cause it is everywhere. Do not do that. It WILL kill you. The wide blade is the neutral. In color code, The black wire is hot, goes to the gold screw, or to the narrow blade. The white wire is neutral, goes to the silver screw, or to the wide blade. The green wire (if there) is ground, goes to the green (or ground) screw, or the round blade. The real danger lies in the fact that some older radios used an AC input with a floating chassis and no transformer. If not hooked up properly, the chassis can be hot. If you are touching a ground and the hot chassis at the same time, YOU will complete the path, and maybe with spectacular results. If you have any radios with only a two blade plug, test it to ground with a DMM and try reversing the plug till you see no (or very low) voltage difference

between ground and chassis. Then mark it.

Collector value be damned, I put correct grounded AC inputs on all my radios.

Date: Sat, 17 Feb 2001 15:46:47 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] hot side, is it?

To that I'd add -- be sure to check your outlets especially in an older house that was refitted with grounded outlets. They may be wired backwards or the ground may not be connected -- if there is a ground available. While not foolproof, those little plugs with the three indicator lights helps to make quick checks -- also at the end of extension cords as well as the outlet.

Another thought: You may find an old rig that already seems to have been upgraded to three wire. Don't bet your life on it. Same question -- wired backwards? Is the ground lug connected at all. I got an R-390A that had a nice 3-wire cord on it. I didn't happen to notice that there was no ground connection on the back panel -- for some reason I temporarily had the misaprehension that the ground was under the cover. The the unintentional "tingle" test was positive.

Meanwhile, as Cathy was saying -- I also betcha we don't all understand what
Tom wrote. I'm still not sure when it's correct to strap the neutral and ground together and not to service ground something.

I dunno, I've got this problem -- Going along great, so sooooo smart, then alluvasudden .... duhhhhhh...

Date: Sat, 17 Feb 2001 21:47:10 -0000
From: "Michael P. Olbrisch" <kd9kc@elp.rr.com>
Subject: RE: [R-390] hot side, is it?

> To that I'd add -- be sure to check your outlets especially
> in an older house that was refitted with grounded outlets.

I do that so automatically that it never enters my head to advise someone else to do it. Thanks.

> They may be wired backwards or the ground may not be
> connected -- if there is a ground available.
> Another thought: You may find an old rig that already seems
> to have been upgraded to three wire. Don't bet your life on it.

Good words... don't bet your life on it. Bottom line... if you are not sure, PAY for someone who is to do the job for you. The few bucks you save are not worth the cost of a funeral. Yes... it seems so simple. And it may truly be... but dozens of people die every year from electric shock.

Date: Sat, 17 Feb 2001 16:47:55 -0500
From: Thomas W Leiper <twleiper@juno.com>
Subject: Re: [R-390] hot side, is it?

It is not that complicated. If you examine the schematic for how you intend to install a sub-panel, just ask yourself a couple questions:

1. If normal load current is flowing, is there any possible path other than via "hot" and "neutral"? (Correct answer - no)

2. If a "hot" line shorts to neutral, what path will all the fault current travel back to the breaker/fuse? (Correct answer - the neutral back to the prior panel)

3. If the "hot" line shorts to "ground", what path will all the fault current travel back to the breaker/fuse? (Correct answer - the ground back to where it is bonded to neutral at the main panel or service disconnect)

4. If the "neutral" becomes open can any normal current flow via another path, such as ground. (Correct answer - no)

If you bond the neutral to ground on a sub-panel that has a direct ground path (not "earth") to the main panel such as EMT or armor cable ("bx"), some of the normal current will flow via the ground path as well as the neutral. If the neutral becomes open, ALL the current will try to flow via the ground path, and any loose connections, such as lock nuts and fittings may overheat and cause a fire. So you only bond the neutral to ground where there is not a direct ground connection back to the prior panel or service enclosure. Otherwise, you remove the screw or strap bonding the neutral to ground, and make sure that your circuits are connected to separate neutral and ground blocks in the panel. And the ground block MUST be an approved block designed to be installed in that panel, not some hokey thing that you cook up, no matter HOW robust you think it may be. If you have any other doubts - HIRE AN ELECTRICIAN!!! By the way, did you check out that "rack" link I sent you the other day?

Date: Sat, 17 Feb 2001 18:09:32 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: RE: [R-390] hot side, is it?

Lots of excellent advice in this thread. May I suggest that anyone who

doesn't understand crystal clear what Tom and Mike are saying, that one stop right there and take that as a signal to get an expert in there who does?

Date: Sat, 17 Feb 2001 15:41:21 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] hot side, is it?

>If the neutral becomes open, ALL the current will try to flow via the
> ground path, and any loose connections, such as lock nuts and fittings may
> overheat and cause a fire.
++++++++++
Lets consider this one for a minute. These ground connections are conducting line voltage back to the panel, they are MINIMUM standard connections as per the National Electrical Code for safety. My point is that even though they can carry line voltage and big current they aren't good for dissipating noise or stray RF voltages, they're really crappy connections at those voltages. Consider your flashlight, if you leave the batteries in it for a few years will it work when you want it? No. That's at 3 volts DC. So just how good does the connection have to be to be reliable at a few milivolts? Then what is the resistance between the ground rod(S) and the actual ground? Have you cleaned your ground connections in the last few years? But this doesn't get to be a real concern until you're trying to track down "noise" on the ground going to the computer equipment that runs something really expensive.

Date: Sat, 17 Feb 2001 20:00:25 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] hot side, is it?

While setting up wiring for a friend name Green's wood working shop, I constantly reminded him that the Green wire is to PROTECT GREEN!

It's important that the green safety ground wire return to the power neutral ONLY at the main panel and that neutral and safety ground be grounded to a rod or metallic water system or both. While the earth is not a great conductor, its closest to the potential we reach just standing around. Its very important that no load current return through the safety ground because if the safety ground ever opens for any reason, it (and all connected equipment cases) will be energized through the impedance of that load or loads with 120 volts. Sure there's impedance but it won't limit the current to something safe for people. What's safe for people isn't useful for lighting, radios, or power tools. On one construction site I knew about, connection safety ground to neutral at the end of a long cord where the neutral wire was broken by truck traffic driving over it killed a carpenter.

The subsequent claim cost the electrical contractor who supplied the extension cord, about $250,000.

Date: Sat, 17 Feb 2001 23:53:38 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] hot side, is it?

OK, let me see if I've got this straight, though I think there's something left out between the lines.

> Its important that the green safety ground wire return to the power
> neutral ONLY at the main panel and that neutral and safety ground be
> grounded to a rod or metallic water system or both. While the earth is
> not a great conductor, its closest to the potential we reach just standing around.

Understood - but is neutral grounded somewhere upstream, or would that be at the neighbor's house if on the same transformer? Whether or not that's so, does it mean anything? Is that ground too far away ohms-wise? Just curious. What about at the "high tension" level -- not the big towers, but the uninsulated green wires at the very top of the poles that feed the transformers. Usually there are three, I think.

> It is very important that no load current return through
> the safety ground because if the safety ground ever opens for any
> reason, it (and all connected equipment cases) will be energized through
> the impedance of that load or loads with 120 volts.

My first reaction was -- so what good is that safety ground (green wire) then anyway? Of course, normally no load current should run back throught he safety ground -- but abnormally, I thought that was the idea. Part of what I suspect is missing here is that the wiring should be such that the onset of any load current returning to ground should be tripped by a breaker or fuse. Still feel like I'm missing something. What miswiring situation would set up load current returning through safety ground under regular operating conditions, or any conditions? Here's where the breaker tripped and the cerebral cortex went into standby "duh" mode.

> Sure there's impedance but it won't limit the current to something safe for people. What's >safe for people isn't useful for lighting, radios, or power tools.

So what is that typical threshold "kill" voltage. (Of course, if your reflexes take over you could bash your head or impale yourself on something and below lethal voltages. One of the first posts I read on this list was from someone who had just returned from the hospital after taking some

stitches in his hand as a result of being thrown across the room, so to speak.)

On one construction site I knew about, connection safety ground
> to neutral at the end of a long cord where the neutral wire was broken
> by truck traffic driving over it killed a carpenter. The subsequent
> claim cost the electrical contractor who supplied the extension cord, about $250,000.

That's an expensive extension cord. On the other hand, doesn't seem to be much compensation for the death of a working person. I guess they weren't using a contractor's isolation transformer -- would that have helped? OK, so I still want to know -- when IS it proper to safety ground neutral in a radio or anything? Or is that never? Lemme try this. Way way back a long time ago, I built one of those 3-tube Lafayette regen receivers. No power transformer -- "hot chassis" -- and, back then, both lugs on the power plug were the same. You could plug it in wrong or right with equal ease. The recommended procedure was to plug it in, turn it on and then check the chassis to ground (screw on the socket plate) with a little neon dingus. If it lights, flip the plug around. Those kit SW sets had metal front panels. Common five tube table radios of the past relied on wooden or plastic cabinets and knobs. However, I just took a look at an old Emerson late '40's radio -- yup, all bakelite in terms of the normal "user interface". Even the plastic back panel screws into bakelite, so that's safe. BUT ... the chassis is mounted to the case with screws that are exposed on the bottom. So, if you had it plugged in for hot chassis and then went to pick up the thing to move it ....?????

Date: Sun, 18 Feb 2001 00:25:53 -0500
From: Thomas W Leiper <twleiper@juno.com>
Subject: Re: [R-390] hot side, is it?

If you want to "upgrade" an AC/DC radio such as those, just put on a two-prong polarized plug with the wide blade on the chassis side. DO NOT use a three wire grounded plug and attach the ground to the chassis. That would result in improper currents under normal operating conditions. Tube heaters, anyone?

Date: Sun, 18 Feb 2001 10:25:54 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] hot side, is it?

The neutral is grounded by a rod at the main panel, at the transformer (whether on the pole or on the ground) and that neutral is connected to the distribution neutral that is grounded with a rod or coil of wire on the butt of the pole ever few poles. I'd prefer that the customer neutral and

distribution neutral were not wired together, and that their ground rods were separated at least a couple rod lengths so that high voltages from lightning on the distribution system were not impressed on the customer system, or in the case of cattle milking operations, normal voltage drops not impressed on the wet parts of the cow while milking. Unfortunately the industry is focused on grounding, not isolation and refuses to accept the concept that there can be greater safety with isolation than with the passion for grounding. Their argument is that its necessary to connect primary and secondary neutrals so that when there's a primary to secondary insulation breakdown in the transformer that the primary voltage is shorted, not applied to the user's ground network blowing up equipment. Cows grumble at a fraction of a volt from a milking machine, and quit cooperating with the milker at a volt or so, and quit allowing milking at a couple volts, then get sick and may die from trying to hold the milk.

Electrically for equipment operation, that green wire has no function. Hence the handyman may tend to neglect its care. At one time in Romex one size smaller was accepted for the ground. The function is to divert shorts to the shell of equipment through the ground wire, not through the user. The function of a GFCI breaker is to trip at a current below the threshold of feeling for a user, its not dependent on the presence of a ground wire. A ground wire is simple but breakable, a GFCI is complex and sensitive, depends on which or both to depend on for one's life safety. A GFCI can fail, a ground wire can fail. In OSHA rules for several years a program for testing ground wires on tools and wiring was accepted in place of GFCI. I dislike portable GFCI on the construction site, because its far to easy to blame a trip on the GFCI than the faulty tool and to remove the GFCI to test the tool, frying the tool user. In the broken neutral case I mentioned, the carpenter knew the value of the ground wire and after being tickled, had stopped and inspected the splices in the cord making sure the ground wire was continuous from saw to plug. Had he opened the ground wire he'd not have been hurt because the leakage in the saw was very low. I checked it.

Voltages of shocks vary wildly according to skin moisture. The only consistent values are for currents. The accepted threshold of feeling is about 10 milliamps. The accepted threshold of loss of muscle control, ("Can't let go") is 25 milliamps. The accepted threshold of ventricular fibrillation is 50 milliamps. Somewhere about 200 milliamps the heart is stopped completely, a safer condition. A stopped heart is usually itching to run and will take off at any initiative like falling down. A heart in ventricular fibrillation is a killer. The heart reflexes are satisfied but no blood is moved, requires a big shock to get stopped. The defibrillators not only stop a fibrillating heart but give it a big kick to run normally. About 4 minutes without blood circulation is about all the brain can stand.

120 volts is enough to cause ventricular fibrillation. Voltages and currents that cause the heart to stop also tend to cause significant to severe burn damage to skin and muscle. Often the muscle is burned all the way to the bone. Physical recovery from power line contact burns can take years, and mental recovery sometimes never occurs.

Sometimes a shock through a limb will cause muscles on both sides of a bone to contract and in strong limbs has been known to crush the bone or rip ligaments loose.

About $250,000 has been what I've noticed in death settlements in Iowa in decades past. I've not found out more recent settlements.

Any isolation transformer is not part of the National Electrical Code just for work place safety. Its only allowed to isolate noise if grounding won't accomplish it first.

The safety ground and neutral should never be connected together any place but the main panel.

Polarized plugs and properly polarized outlets help with the AC/DC radio. The AC/DC radio was never the epitome of user or repair shop safety. Sometimes the screw head on the bottom were damaged by setting the radio on a grounded iron radiator while plugged in for a hot chassis. A lot of shops used an isolation transformer when working on AC/DC radios and a lot didn't. There was a time when shop rates were small enough it was profitable to repair a $20 item.

Date: Sun, 18 Feb 2001 09:48:53 -0800
From: jan@skirrow.org
Subject: Re: [R-390] shocking.....

All of the other replies you got so far about house wiring etc. offer good advice! Everything should have a good reliable ground (and one that you know is a ground!). But sometimes it's even simpler. Lots of old gear (like our beloved R-390As) have line filters that include capacitors to ground. These capacitors often are leaky enuff so that you can feel a 'tickle' when you touch that piece of gear and something else that is properly grounded. Consider this 'tickle' an alert for those who want to live to a ripe old age!

Date: Mon, 19 Feb 2001 11:30:41 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Yes, Virginia,,,,,there is 120 volts!!!!

According to my list of consulting clients, more were widows from 120

volts than from 480 through 7200 volts. Though some died violently from 7200 volt power line contacts, some survived badly maimed. The difference was that the higher voltage injuries stopped the heart, while 120 put the heart into fibrillation where there is NO survival without a defibrillator in 4 minutes. Being wet makes 120 volts a lot more hazardous. Yes I know the tales of "electricians" who use a finger to check for a live circuit. And I also seen such electricians get fried because there was a hand rail nearby that was solidly grounded. GFCI are good for all outlets where tools are going to be used, especially wet areas. Unfortunately the line filter in the military receiver draws more current to ground through large (and probably leaky) capacitors to trip the GFCI. Probably the best solution is to replace the filter with one designed to be compatible with GFCI which means smaller capacitors to ground, larger capacitors line to line, and more dependence on a set of coils for noise rejection. BUT it isn't original which upsets the restoration purest.

Date: Sun, 18 Feb 2001 12:48:28 +0200
From: "galpinp" <galpinp@freemail.absa.co.za>
Subject: Re: [R-390] hot side, is it?

Just a warning for folks on the UK/European/South African (and Australian??) 220 V systems.

1. Don't ground either of the incoming feeds, Live (obviously) or Neutral. These systems ground the Neutral at the sub-station ONLY.

2. Do ground all metalwork, either to the Earth in the domestic distribution box, which should have been properly installed (worth checking!), or to a known good Earth of your own (after it's been checked)

The old radios and TVs without transformers have a 50/50 chance of the chassis being Live (220V) or Neutral (up to 50V or so, dependent on out-of-phase current flowing back to the sub-station.) I leave you to guess which is safer, and wire accordingly.

Date: Fri, 23 Feb 2001 20:10:09 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: [R-390] OT Hot Chassis Situation

Sorry for the OT post, but I don't know where else to go with this.

Coincidentally, a few days ago, there was a thread on electrical safety which got into transformerless hot chassis gear. The better solution was to add an isolation transformer. The next best was to "upgrade" to a properly wired polarized two conductor line cord.

I've been tinkering with an old '50's RDF receiver. It's basically a standard 5-tube battery radio with a sixth tube which I suppose is the BFO. (Three 1U4's, a 1U5, a 3V4 and a 1L6 which is probably worth more than the radio.) Anyway, get this: BTW it works with no hum, and pretty well considering there isn't much radio in the radio. I did the usual -- plugged it in and turned it on without touching anything metallic on it. Measured AC volts from the chassis to service ground -- 125 VAC. Turned it off, reversed the plug, turned it back on -- about 1 VAC. Everything's fine - right? -- NOT SO..... Turned it off while leaving it plugged in the same way. 1 VAC became 125 again with the power switch off.

So basically this (all metal, panel included) radio gives the consumer a choice -- get electrocuted with the radio on, or get electrocuted with the radio off (just when you thought it had to be safe.)

Probably simple, but would someone please explain why this goes hot when you turn it off and there's no right way. Also please refer me to the nearest remedial electrical school. Don't know if this means something, but the removable back panel with tube location chart and battery instructions says to plug the AC cord into the radio chassis when operating from batteries. There are slots in the chassis where it fits and it actuates a switch when you do that. Needless to say, I don't have a schematic. But when I got up this morning, I apparently forgot everything I ever knew about electricity, so it probably wouldn't do me much good anyway. ;-)

Date: Sat, 17 Feb 2001 08:46:10 -0800 (PST)
From: a b <c18cont@yahoo.com>
Subject: [R-390] shocking.....

Hello, friends, I AM WORRIED... I am worried about the info given by Tom..... In franks' stuff, if you touch some things at the same time, you will get shocked; others, not so. He has the radios, some old hi fi, and test eguipment, mostly 2 wire kind of power cords, all plugged in. He has a whole bunch of plugs-ins he made up...

I will have him read this over and over, and hope he understands it. I think everyone ought to look at this problem some more. A few of the people are like me, I bet and don't understand the grounds needed, I bett!!!! Can't it be very dangerous, like just touching hot wires?

Date: Wed, 5 Dec 2001 21:26:56 EST
From: DCrespy@aol.com
Subject: Re: [R-390] Power Line Noise. Grounding

Just a quick comment that worked for me in my Texas QTH (where I had

some noise problems). This one was in the ARRL Handbook. An open wire to ground (or to a water pipe connection that is physically far from real earth/dirt ground), just becomes another antenna and picks up more noise! I used coax all the way to a point where the water pipe went into the soil. The inner/center conductor (only) connects this point to the radio chassis. A 0.01 uF disc cap is connected between the outer shield and the center conductor at both ends of the coax. The shield is therefore above DC ground, but it apparently protects the ground wire from becoming another antenna. It worked for me!

Date: Wed, 19 Jun 2002 19:23:18 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Ham Shack Grounding Help!!!!

> ...in this old house. It has the old two wire system.....

Hmm,..... So far,..... all but one of the replys to this one have dealt with grounding. The problem here is that there is NO grounding!! Not with the old two-wire system. Tighten the coax connectors? Well, that will bond everything tighter together, but there is STILL no ground! Actually, in this case it may just make a bigger antenna for the noise to be received with. Wayne's cabinet is connected to a cold water pipe,..... why? RF ground? The cold water pipe isn't a very good RF ground, rusty connections, is it metal all the way to the ground? Are there rubber washers in the meter connections? Is there a jumper acrossed the meter? How far does the metal pipe travel when in contact with the ground before it connects to plastic? Any rubber washered splices in the ground? Copper or steel pipe? Kim, you need your house re-wired! Or at least your shack so the noise has a PATH to ground. Remember, this noise is a very LOW voltage you need a very GOOD connection to ground so there is NO resistance to that signal. That means BIG wire and SHORT runs. If the walls are plaster you may be able to re-wire the first floor by mounting Wiremold boxes on the base boards. OR you could cut flush-mount boxes into the baseboards. Usually plaster walls have wide enough base boards to accomodate such a plan. If your wiring is THAT old all the way through then you probably don't even have a ground at the panel! Even if you have some three wire receptacles they are NOT grounded to anything! That two-wire system has NOTHING to short out against! Except, maybe, the neutral, IF the connections in the panel are tight enough to pass enough current to blow the fuse. Got any "blue" lugs in YOUR panel? Got fire insurance? You'd be amazed at the scary things I've torn out of old houses... I hate old houses, just finished one and have another to do next week, the owner has NO idea what its going to cost either,..... she'll need a new service to add ANYTHING! It hasn't been worked on in 40 years! ZZZZzzzzt! POOF!!

From: "AI2Q Alex" <ai2q@adelphia.net>
Subject: RE: [R-390] Ham Shack Grounding Help!!!!
Date: Thu, 20 Jun 2002 09:38:13 -0400

Kim: You might also want to try using different ground wires from each piece of equipment (rig, computer, monitor, etc.) to a *single* ground point, as in a star pattern. Running ground lines in a daisychain fashion invites ground loop noise.

Date: Thu, 20 Jun 2002 23:40:56 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Ham Shack Grounding Help!!!!

.....There is 60 v. from the chassis of my radio to the cold water pipe.....

Standard condition. Caused by NORMAL operation of the line filter capacitors.
GROUND your radio to the cold water pipe, PLEASE. Do not use any ground fault interruptor outlets.

>Not good at all. I am going to get an electrician in here as soon as possible to >see what we are going to have to do to fix that.

That is caused by the RADIO line filter. NOT by the electrical system in your house, except that you have ungrounded outlets.

Date: Fri, 21 Jun 2002 00:04:50 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Ham Shack Grounding Help!!!!

That 60 volts from the chassis to plumbing is probably the leakage from the line filter caps. There was a great deal posted on this. They will cause a ground falt interrupter to trip. There are a number of workarounds, if your electrician wants to put one in your shack -- like removing the filter, etc.

The PC power supply is a likely suspect, however there are a number of other
variables in PC construction:

The cases keep getting cheaper and cheaper -- imagine $30 for an ATX case with power supply and two fans -- what can it be made of -- tin can stock complete with coating/varnish. I've seen three basic formats -- tin can frame and back with painted steel U shaped cover, same with removable sides and back, and variants with plastic sides with either thin metal shields inside or just conductive paint. You have to make sure somewhere on the mating surfaces the paint or coating was removed or masked,

otherwise a panel can radiate rather than shield.

The motherboard and how it's mounted is another thing. There should be at least one metal screw making contact with a ground pad on the MB which then goes into a metal standoff. If the MB was installed only with plastic standoffs, it isn't grounded properly. Motherboards also vary -- number of layers with the better ones having ground/shield layers.

Also, the main ground point for the whole business is the PS to case connection. They usually mount with four mounting screws, but both the PS and case frame have that coating. It's possible to have a bad ground if it's just depending on the heads of those screws.

So, you might check that out -- but, sounds like you've got no real ground at all at your outlets. Your radio wouldn't tingle with 60 vac if it has a proper 3 wire power cord going into a correctly wired and grounded outlet. Be especially careful until all that is fixed -- and then still be careful after that.

You should have your whole electrical system checked out -- as the electrician will, no doubt, recommend.

Date: Thu, 20 Jun 2002 22:34:52 -0700
From: Dan Merz <djmerz@3-cities.com>
Subject: Re: [R-390] Ham Shack Grounding Help!!!!

I can agree with the 60 v normal when there's no grounded outlet - I have pretty modern wiring in my home but one day not too long ago discovered 60 volts chassis to ground even though it should have been zero. I discovered this by RF noise associated with touching a wire from an external ground rod located outside the house to the radio chassis, and then measuring about 60 volts AC between the chassis and the ground wire. It took me awhile to discover that on the leg of my wiring where I have my radios there was no ground coming to the 3 prong outlet or to any of the several other outlets on the same circuit - easily detected by plugging in one of the circuit checker gadgets - but not so easy to remedy. Fortunately I was able to get into the junction box where the problem originated (conveniently left somewhat visible by the previous owner) and found a ground wire that was not firmly connected to the bundle of ground wires connected there. Too many connectors in an undersized wire nut and with no room to tighten it sufficiently !! I fixed that by better type of connection and the 60 volts went away. I feel safer now. I guess if one of those caps (the one on the hot side) that put the 60 v on the chassis happens to short, I'll now be saved by my circuit breaker or radio fuse rather than taking the potentially lethal current myself if I happen to be grounded. Dan.

Date: Fri, 21 Jun 2002 08:38:39 -0400
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] Ham Shack Grounding Help!!!!

One should never rely on the outlet ground, there are just too many variables..... My station ground is based on the Handbook model. A 1/2 inch copper pipe is mounted under the desk and braid is run from the pipe to EACH piece of equipment. A heavy wire is run from the copper pipe to the earth ground system. On installation, the ground braid is connected to the chassis before the radio is plugged in. As an additional safety feature, the Shack outlets are connected to a DPDT wall switch. In the off position, all radios are electrically dead.....

Date: Fri, 21 Jun 2002 11:02:29 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Ham Shack Grounding Help!!!!

>Roy/Kim, I can agree with the 60 v normal when there's no grounded outlet
-
The capacitors are NOT "Leaking". They are simply passing a small AC current because they are ... (guess what?) capacitors! The line filter capacitors form a voltage divider to establish half the line voltage on the chassis if the chassis is not grounded.

> pretty modern wiring in my home but one day not too long ago discovered >
> 60volts chassis to ground ...there was no ground coming to the 3
>prong outlet or to any of the several other outlets on the same circuit - easily
>detected by plugging in one of the circuit checker gadgets -

Hear, Hear! for that cheap circuit checker.. No home should be without one! No one should fail to use it.

> I feel safer now.

You ARE safer now.. good for you (and your would-be heirs.)

>I guess if one of those caps(the one on the hot side) that put the 60 v on the chassis happens to short, I'll now be saved by my circuit breaker or radio fuse rather than taking the potentially lethal current myself if I happen to be grounded.

The R-390A line filter contains two bypass caps from each line to chassis. The R-390 (Non-A) filter has, I think, three from each line to chassis. In

both cases the bypass capacitors are PRIOR to the radio line fuse(es). You can get full house circuit current from the chassis if the capacitor shorts. Most of us are to some degree "grounded" all the time. Before I step off this soap box, just one more thing: Do not ever, repeat do not every use a fused line cord plug for any reason. It can kill you.

Date: Fri, 21 Jun 2002 09:06:53 -0700
From: Dan Merz <djmerz@3-cities.com>
Subject: Re: [R-390] Ham Shack Grounding Help!!!!

Jim, I bet this is a dead horse ready to ride.... the thought of having a ground pipe under my desk or workbench conjures up the image of working on a radio while standing in the bathtub filled with saltwater.. I offer this as a consideration, not as a criticism. I'd prefer to have a good ground where I can see it and not necessarily become intimate with it. I'm sure your system serves you well and I admire your effort in implementing it. If I had a lot of equipment in fixed locations, it might serve me. My main concern when working on anything electrical is to keep all parts of my body at a single potential and to avoid the accident of touching different parts of me to different potentials. Half of the concern is the location of ground relative to my body. The other half is keeping out of touch with the "high" potential areas. On a lot of projects on old radios, I use a fused isolation transformer so I know earth ground is not part of the equation as far as the electrical mess that is setting in front of me. Maybe I need to rethink whether your system could help me - one problem I have is getting a reliable "water pipe" type ground connection into my radio area. Dan

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Date: Fri, 21 Jun 2002 12:34:50 -0400
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] Ham Shack Grounding Help!!!!

Dan, In the same vein..... The Shack ground is driven ground rods.....it serves for AC/DC and RF. The pipe is at the bottom-back of the table for convenience and cosmetic reasons. The workbench is another story.....there I use a single cable from chassis to ground. A pipe ground would be handy for the test equipment. Additionally, I use rubber mats in the shop and the Shack is carpeted....other common sense rules apply

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From: "Chuck Rippel" <R390A@R390A.com>
Date: Fri, 21 Jun 2002 17:32:01 -0400
Subject: [R-390] RE: Shack Grounding

A couple of suggestions. First, install a 3 wire power cord. I use old plug-in computer power cords and cut the female end off. Make sure the black lead is attached to the side of the hash filter on the receiver that is fused. I believe its marked "B" but don't hold me to it. Remove the fuse and prove

the connection with an ohm meter. Put a ring terminal on it and hook the green ground lead under the nut that holds the terminal cover on. While self-serving, let me suggest that I rebuild the filter caps for you. Chances are good that they are leaking badly.

From: "Richard Biddle" <theprof@texoma.net>
Date: Fri, 21 Jun 2002 16:38:03 -0500
Subject: [R-390] Re: Ham Shack Grounding Help!!!!

The R390A is notorious for having 60 volts to ground due to the design of the line filter. Then there is the trouble of a ground versus a GROUND. Even in newer homes the ground of the electrical system is not a really solid ground. My home passed all the wiring tests and there ground back to the service entrance was solid, however, the ground used at the service entrance was not as good as the RF ground in the shack. So we have a case where the radio ground would rise up and bite a little.

The best thing is a massive ground system tied back to the service entrance ground. That is not too handy just for shortwave listening use. In that case I would make sure that the ac wiring in the house was okay (plug for electricians) and then do what I did. I run my radio though a topaz isolation transformer and then through a variac. I use the variac to soft-start the radio and set the line voltage to 110. My grounds are all good on the bench and there is no leak from the radio (grounded chassis 3-wire plug) to the bench test equipment ground or the antenna ground. It won't trip the GFI either.

Date: Fri, 21 Jun 2002 17:56:42 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: Re: [R-390] RE: Shack Grounding

Hello, all, I agree it's a good idea to verify which terminal on the R-390A's line filter gets the hot lead-- "A" or "B." In rare instances it can be reversed. So, be sure to check that the fuse post tests "hot" in each instance. Additionally, if you use a power cable with leads colored differently from the usual white-black-green, again, verify which lead goes where by checking its three prong plug. To do so, point the plug towards the power receptacle with the ground prong downward. The left prong should be larger than the right prong. The left prong is for the neutral and the right prong is for the hot wire. Finally, check out the power outlet receptacle with a meter or neon test lamp. Looking at the receptacle and assuming the ground is downward, the hot lead should be the right hand slot. Here is where one of those receptacle testers will come in handy. They're cheap and useful for checking out ALL your power receptacles. Whether the house wiring is new or old you may be surprised at what you find.

Date: Tue, 31 Dec 2002 19:40:17 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Finally!!! NOT!

Aw, geez! You CAN get a nasty shock from the neutral IF, I said "IF", the neutral is broken and YOU are between the LOAD and the PANEL!! If you lose your neutral on your house service you will get 240 acrossed ALL of your 120 volt circuits. The appliances will form voltage dividers with the 240 volts divided according to the appliances' impedance. How this usually happens is that the covering on the service entrance cable going down the side of the house deteriorates then the aluminum wires wrapped around the two hot wires corrode to powder,..... later when the fire trucks leave a smoldering hole,.....Oh, well,..... you get the picture. Checked YOUR neutral lately? Do you know what to look for? Have a Happy and SAFE New Year!

From: "Bill Hawkins" <bill@iaxs.net>
Date: Wed, 1 Jan 2003 09:54:19 -0600
Subject: [R-390] The ground round

While we are talking about power near ground ... My son bought a 55 foot power boat for fishing parties in Ocean City, MD. The wiring needed some work, and I learned some new stuff about power and grounds.

A common ground point is used to control noise fed to radio and navigation (autopilot, GPS, LORAN) electronics. Wired to it are the engine blocks (and battery negative), a 'quiet' battery negative for the electronics, battery charger negative, ship's AC generator green, shore power AC green, a copper tape from the SSB and a copper tape from the other electronics.

When the ship is at sea, it is 'grounded' to seawater by a couple of porous bronze plates. This is mostly for the benefit of the 200 watt SSB transmitter and its quarter wave whip and antenna tuner. The SSB also has 100 square feet of copper screen for a counterpoise, which reduces the amount the autopilot changes course while transmitting.

When the ship is in a marina, the bronze plates are still there, but shore power adds a green wire for ground to the mix. There are two interesting things about shore power. First, the white wire isn't always neutral - sometimes it is hot and black is neutral. So the shore power breaker has to break both wires. Second, the green wire could be carrying electrolysis (corrosion) current, perhaps from another boat.

So you can't just tie the shore green to boat ground. Worst case, the electrolysis current is strong enough to evaporate one of your through-hull fittings in a day, leaving a hole for seawater to enter the boat. Or weaken it

enough so that it breaks at sea and finally turns on the high water alarm.

The fix is called a "Galvanic Isolator" in the green wire. Two diodes in series begin serious conduction at about 1.2 VDC. That's high enough to prevent most seawater electrolysis. You need 4 diodes, two in each direction, big enough to pop the shore power breaker if there is a fault from hot to ground, perhaps from the block heaters or battery charger.

And then there's the problem of lightning, but that's another long story.

The Coast Guard building code for boats does not allow any kind of aluminum wire or terminal in a power circuit.

My son's boat does not have an R-390. He already has an anchor.

From: "Michael Young" <myoung76@bellsouth.net>
Subject: Re: [R-390] Some progress
Date: Sun, 5 Jan 2003 14:01:58 -0500

Yeap....here a mile back from the Atlantic Ocean in Satellite Beach, FL we have had that problem with the outside service entrance/meter box. Heard a frying noise one day coming from the meter box, called the power company who came and cut the service wires....with big choppers. Then I had to call an electrician and our code enforcement official (who lives across the street). Electrician came and put a new entrance box (Aluminum!) and conduit (Aluminum!). Power company came back and hooked power back up using Aluminum(!) sleeves to crimp the wires back. I asked about the black goop they used (De-ox or whatever) and he said the company no longer used it (!). He thought the policy was a bunch of BS so he had some and used it anyway. As it was, that entrance cable and box lasted close to 30 yrs before trouble showed up. Everything from the service panel inside the house is copper (yay!).

Date: Sun, 05 Jan 2003 14:22:27 -0500
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] Some progress

I buried about 900 ft. of aluminum fence wire as ground radials for a 40-80M vertical. About 10 years after installation the area was dug up for a sprinkler system. All the aluminum wire was brittle and badly deteriorated.

Date: Sun, 05 Jan 2003 14:25:55 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Some progress

Is this a job for an electrician -- or the power co.? There are two front-end power cutoffs I'm aware of -- The kind of meter that pulls out where the power co. technically has to come to break and replace the seal (to avoid stolen electrons). The other is the main breaker or cartridge fuses, depending. But it sounds like the tightening of some of this stuff is ahead of all that and best left to a pro, or the power co., especially the "up the pole" part of it. Of course, you 'lectricians are fond of replacing outlets and switches without flipping the breaker 'cause you're immune or something. (Does your carrier meter peg with the '390A off when you walk by?)

So ... I guess the question is: What do we say to the power co. to get them to come over and check it out? At home, as far as I know, the last time this was done was when we upgraded the service -- in '86. At the office, it was done last year when we had the main fusebox (three-phase) replaced -- because one of the contacts burnt up -- probable due to looseness. It's on the same wall where the 18-wheelers pass by on their way to camp overnight or make a U-turn. Also not far from where the dumpster guy likes to set the thing down hard. Not to mention the LIRR commuter trains barreling by at 70 mph. rattling things enough to loosen the flourescent tubes. Arghh.

Are there some magic words like "I think I hear crackling noises!" Somehow I suspect if I just tell 'em some electrician I know told me to have it checked won't be enough Then -- how to sneak up on 'em to find out if your ground is really a ground? This is Lawn Guy-Land, east of Brooklyn. Just insisting won't work -- you need a good story here to get around the phone reps. Needs to be motivating enough to get the power co. guy without attracting the volunteer fire guys with swinging axes.

From: "Kenneth G. Gordon" <keng@moscow.com>
Date: Sun, 05 Jan 2003 11:41:25 -0800
Subject: [R-390] Re: Electrical panels and grounds...

This thread reminds me of a short story Roberta Barmore told us on the Glowbugs list a while back. She is Chief Engineer at a big combined AM/FM/TV station in the midwest somewhere, and a ham. She was walking by the main three phase panel which fed power to the entire transmitter site and noticed that it seemed to be somewhat warm. Then a few evenings later, she thought she saw a slight reddish glow, so she called an electrician. He showed up the next day, and after putting down some thick rubber mats, and removing the panel, crawled back in under the panel and looked up. Her words were, "...then he said a very bad word and backed out slowly..." Apparently the center one of the very large copper buss bars was glowing red hot. When the panel was assembled at the factory, the assembler had misaligned the center buss bar when drilling the mounting holes in it and had offset it to one side or the other by quite a

distance. There was a very small gap between it and one next to it. Further, the bolt holes were damaged in such a way that the bolts couldn't properly clamp the buss bar to its mount, so the current carrying capability of the buss bar was signifcantly lessened. So much so that it heated up with the current load and loosened the bolts, making it hotter yet, and so on. They had to cut the station power WAY back to keep the panel from burning up while waiting for the replacement panel.

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Sun, 05 Jan 2003 14:10:25 -0600 (CST)
Subject: Re: [R-390] Some progress

>Aluminum isn't good for a ground, the NEC doesn't allow it within 18" of the dirt because it deteriorates so quickly.

Well, it's just temporary, and the outside connection is well sealed. Thanks for the heads-up.

From: "Bob Tetrault" <r.tetrault@attbi.com>
Subject: RE: [R-390] Re: Electrical panels and grounds...
Date: Sun, 5 Jan 2003 12:12:06 -0800

Interesting way to illustrate I squared R... Like compound interest, exponentials are the eighth wonder of the world. All the others may be lost in antiquity, but that eighth one keeps rearing its beautiful head...

Date: Sun, 05 Jan 2003 15:48:38 -0500--------
From: "Gregory W. Moore" <gwmoore@moorefelines.com>
Subject: Re: [R-390] Re: Electrical panels and grounds...

This story reminds me of an incident which happened during the early '80's. I had a friend who used to bother me for all his electronic/electrical repair needs, with absolutely no thought of time or compensation. At any rate, he was calling me after an unsuccessful bout with the cable tv company about reception in his house. I don't know exactly why I said I would go over and "take a look" (I believe the XYL kind of insisted that I go, as she was friends with HIS XYL,
still is, as a matter of fact) but I did, and I probably saved his house by so doing.

When I got there, I noticed that indeed, the cable was messed up, in fact, it was just about nonexistant. I decided to take a look in his basement where the cable entered the house, and found what the cable company euphemistically referred to as a "ground block" virtually MELTED, and the cable leading from this melted object, out of the house, with the outer cover actually MELTING in some spots, and the whole thing extremely hot. On doing some checking around the various "grounds" I found that they were,

in most cases "hot" anywhere up to line volts. I started looking around, and found , (it was raining at the time) that this idijit was using a pump to drain his swimming pool, the pump had an exposed motor, and the whole mess was soaked, hot (both temperature and voltage). I figured I should check why the neutral and grounds should be so "hot", and found that, for some reason, the neutral had come loose inside of the service entrance panel, the panel was grounded to a water pipe (note, the pipe was PLASTIC, a fact which nobody was willing to take credit for, and the whole mess was, because the cable was grounded to the same clamp, along with the telephone (that still worked, amazingly) the entire system was grounded through the shield of RG-59 coax.

Carefully pulling that stupid pump off line, I proceeded to pull the main fuses, and reconnected the neutral to the buss bar. I also went and purchased an 8' ground rod, proper ground wire, and some Greenfield to protect the wire, as I didn't trust this idjit not to destroy it with carelessness, went through the exertion of pounding that sucker into the dirt under the basement floor, and grounded everything properly. I also moved the bonding clamps off the plastic on to the copper, but stopped short of doing a whole bonding check, since at that time, everything was OK groundwise. I also highly recommended the services of a plumber SAP to get rid of that stupid plastic pipe (That was the ONLY piece of plastic in the whole system, and why someone would have installed it, let alone put bonding clamps on it is a total mystery to me) . Called the cable company, told them what had occurred, and that this idjit was going to need an entirely new coax, and the tap at the pole was probably trashed as well, got the usual "you're probably trying to steal cable service" response, which seems to be the standard cable company knee jerk answer to any intelligent discourse with cable tv service, not that I cared, and the incident was over. NO I didn't get reimbursed for either the rod, my time, nor my knowlege, but I probably saved his house-- My XYL was (and still is) happy that I got involved, so everything was as it should be --hi hi--. I have a hearty respect for grounds, I always had, but this was proof positive of a failure mode which I had not previously seen.

I do enjoy the "glowing ground buss" and "...then he said a very bad word and backed out slowly..." Sounds like an exciting day indeed, and much more impressive than the story above--hi--

---

Date: Sun, 05 Jan 2003 15:54:56 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Some progress

In addition to reacting with oxygen aluminum is very reactive with chlorine. Since there's salt (sodium chloride) all over the place this can be a problem. The oxide layer on aluminum will only go just so deep in a reasonable period of time. As far as I can tell there is no limit to how far the chloride layer will go. I have always wondered about cleaners with

chlorine in them and aluminum chassis radios ....

From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Some progress
Date: Sun, 5 Jan 2003 16:12:26 -0600

Tell them that your blender in the kitchen won't run unless you turn on the lamp in the living room....which won't light unless the blender is running, and that sometimes the vacuum cleaner won't run unless the TV's on. This actually happened at my inlaws house...they had lost the neutral at the meter can. I work for a power company...usually you can get in touch with an engineer in the division that serves your geographic area. They usually get pretty serious if they think they might have to pay for equipment damaged by lost phases and such. (not much chance of damage in a single phase environment)

From: "polaraligned" <polaraligned@earthlink.net>
Subject: Re: [R-390] Some progress
Date: Sun, 5 Jan 2003 17:59:06 -0500

Crap. Does that mean that expensive aluminum fence I just put up will fall over in 10 years. The company said it will last forever.

Date: Sun, 5 Jan 2003 15:40:08 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Some progress

You're lucky it lasted that long, I've seen it disappear in 8 months!! And that was #4!

From: "Kenneth G. Gordon" <keng@moscow.com>
Date: Sun, 5 Jan 2003 16:05:44 -0800
Subject: Re: [R-390] Re: Electrical panels and grounds...

Right you are! In fact, Bobbi mentioned the fact that it had to be built. I forgot to include that.
>
> You didn't mention just how BIG this panel is, I can guess. You won't go to the local supplier and buy one that day! If he put mats down it was probably a HV
> panel, too, probably 12 KV.

Yes, I forget the exact voltage, but it was quite high. There are several hundred KW involved in the (multiple) TRANSMITTERs outputs.
>
> And people just don't understand why I won't do this job for $7/hr.

Right. What a bunch of simpletons people are sometimes. Gee...

Date: Sun, 05 Jan 2003 19:08:59 -0500
Subject: Re: [R-390] Some progress
To: polaraligned <polaraligned@earthlink.net>, r-390@mailman.qth.net

Hi, Make sure the fence is coated with something. That's why they have the funny gold colored stuff on a 390 chassis.

From: "Bob Tetrault" <r.tetrault@attbi.com>
Subject: RE: [R-390] Some progress
Date: Mon, 6 Jan 2003 10:25:47 -0800

I think there must be some regional error here Joe, as all of my service entrances from the pole have been copper, even as late as 96. California and Oregon
---
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Some progress
Date: Mon, 6 Jan 2003 13:05:23 -0600

I work for Southern Company...the largest Public Electric Utility in the US and to my knowledge all of our service entrance cables are Aluminum "Tri-Plex" which consists of two insulated conductors and one bare...all twisted together. I can't speak for what is installed in higher current 3-phase installations. Can't say I have seen any copper cables at all in our warehouses besides direct burial control cables used in substations and generating plants.

Most folks don't know it but all of the lines you see overhead including the large 100KV and 500KV transmission lines are built with Aluminum (bare) conductors. Copper is no doubt better from a conductivity standpoint but it's way too expensive to use for transmitting and distributing electricity. I will tell you that the Aluminum that is used is not the soft, flexible aluminum you might think of...it's some alloy that is like Hard Drawn copper is to standard copper. You can't hardly bend the stuff. Must have better corrosion properties as well...I have looked at conductors that have been in the air for years and show little corrosion or pitting, a good report for the area I live in....Gulf Coast. (read salt air)

Date: Mon, 6 Jan 2003 15:31:05 -0500 (Eastern Standard Time)
From: Helmut Usbeck <vze2gmp4@verizon.net>
Subject: RE: [R-390] Some progress

Guess I'll stick my two electrical cents in here. NYC electrical codes are

still all copper, along with no Romex wiring, just BX. No permit variances are allowed. Nassau and Suffolk Counties next door on Long Island allowed aluminium wire back in the seventies and several fires in new homes were attributed to it. It's not allowed any more with existing aluminium wiring requiring a copper splice before any hookup. The thing to remember about aluminium is it's not a metal.

From: "Kenneth G. Gordon" <keng@moscow.com>
Date: Mon, 06 Jan 2003 13:16:50 -0800
Subject: [R-390] RE:

BX? It was known as "Donkey Dick" by electricians. I certainly hope it has been improved since I had to deal with it. What used to happen is that the spirals would get corroded and then one could get a short circuit to the spiral at both ends. Then the spiral would heat up like a heating element and burn the place down. We were forbidden to use BX. We either used Romex in homes or conduit in commercial buildings. We would use conduit in homes if they wanted to afford it. Properly installed Romex was safer than BX. BX was used by amateurs, or those who couldn't bend conduit.

Date: Mon, 6 Jan 2003 16:28:37 -0500 (Eastern Standard Time)
From: Helmut Usbeck <vze2gmp4@verizon.net>
Subject: Re: [R-390] RE:

Well, you have your electric building codes out there and we have our's here. Yes It's a pain to work with, but if you do any rewiring in a home or buiding in NYC with Romex you'll never get passed on inspection and nowadays get kicked out of Local 3 if you're doing it on the sly. Never heard of any fires caused by BX. You guy's must have been installing it incorrectly. Just like aluminium "problem", incorrectly installed. Maybe you should look up why it's used.

Date: Mon, 06 Jan 2003 16:49:07 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] RE:

Here in Nassau County, BX is required for commercial installations. However, I believe the code varies within the county. When we had the construction work at my office, code required BX -- but only 2-wire BX -- no green ground wire, and that's what the landlord had installed. The armor jacket is the ground -- or is it? Plenty of metal, but what kind? What's the resistance per 100 ft? Not to mention that it depends on a daisy chain of gem box clamps. Actually though, I think a '390 would look impressive with a six foot hank of BX 3 wire coming out of it with one of those glompus plugs on the end. (Feeble attempt to get back on topic.)

--- ---

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
To: r-390@mailman.qth.net
Date: Mon, 6 Jan 2003 15:57:47 -0600
Subject: [R-390] Wire stories

One time, I was installing some drywall anchors and drilled into our service that runs from the meterbase to the breaker box. When the drillbit shorted the outer jacket to one of the inner conductors, it vaporized the drillbit and kind of exploded in my face. Anyway, what were we talking about...?

From: "Kenneth G. Gordon" <keng@moscow.com>
Date: Mon, 06 Jan 2003 13:58:13 -0800
Subject: Re: [R-390] RE:

> well, you have your electric building codes out there and we have our's
> here. Yes It's a pain to work with,

It's not really much of a pain to work with. It is much easier to use than either Romex (properly installed) or conduit. BX is unsafe.

> but if you do any rewiring in a home or buiding in NYC with Romex you'll never get passed on inspection and nowadays get kicked out of Local 3 if you're doing it on the sly. Never heard of any fires caused by BX. How old are you? BX caused fires back in the 1960s and 1970s. Well documented.

> You guy's must have been installing it incorrectly.

Interesting assumption. Are you an electrician?

> Just like aluminium "problem", incorrectly installed.
> Maybe you should look up why it's used.

It's used because the "electricians" who install it don't know how to install conduit. In any case, I don't need to look up why it is used, since I intend to never use it. I have installed "Seal Tight" flexible conduit for motors and other places where it is appropriate, but that is a different material and is not BX.

Date: Mon, 06 Jan 2003 17:26:22 -0500
From: Kim Herron <kherron@voyager.net>
Subject: Re: [R-390] RE:

Isn't this also made with a grounding conductor? The flexible covering is not intended to be a grounding/bonding conductor? As far as power drops are concerned, Consumers, here in MI is still using aluminum tri-plex for

aerial drops, but anything underground is copper. I think that we tend to forget that the local inspection authority is the final say and every state is different. Every time I talk to an electrician from a different part of the state, they have different
things that are spec'd by the local authority. Gets FUN!

From: "polaraligned" <polaraligned@earthlink.net>
Subject: Re: [R-390] RE:
Date: Mon, 6 Jan 2003 17:49:03 -0500

My question ken is that if fires caused by BX are well documented then why are so many commercial buildings required to use it? Why do whole citys require it? Was it an installation problem that caused the fires? What was the mechanism by which the fires were caused? What is different now that it does not cause fires? Just trying to learn, Scott
---
Date: Mon, 06 Jan 2003 18:05:32 -0500
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] RE:

As I understand it, BX is required under the NYC code in order to prevent rats from eating the insulation and causing fires. In Nassau County (Long Island) BX is not required in residential installations, PVC is allowed and is rapidly replacing conduit.

Date: Mon, 6 Jan 2003 15:22:32 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] RE:

Whoa, whoa, whoa, guys! What we have here is a failure,..... oops! Um, what I mean is: BX is an old term, its NOT used anymore. It WAS two conductors with PAPER insulation/filler inside of a "corrugated" metal jacket. What REPLACED it and has taken on the same name/identifier is, the PROPER name escapes me now because I've gotten inthe habit of calling it BX, TOO! It is three THHN insulated wires, hot, neutral, and GROUND inside the same type of metal jacket. This is a much better product. Be sure to use the little red anti-short bushings that come with it. It can also be bought with two hot wires, one black, one red for three-way switches, two circuits sharing the same neutral, or 240 volt applications. Hire an EXPERIENCED electrician! Understand: New York State has NO requirement for licensing electricians, if you don't believe me call the Governor's office,..... hehehehehe Can you say BIG BEEHIVE??????

Date: Mon, 6 Jan 2003 15:34:09 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] RE:zzzzzzzzt, POOF!

> My question ken is that if fires caused by BX are well documented
> then why are so many commercial buildings required to use it?
++++++++
See my post regarding the newer style "BX".

> Why do whole citys require it?
+++++++
Easier/cheaper/faster remodeling. The average office space is remodeled every TWO years!

> Was it an installation problem that caused the fires?
+++++++
YES, with the older style BX there was NO ground except the outer covering which wasn't always tied to the box or panel, which meant there was NO ground. This was mostly on stuff installed in the '40's or '50's that was still in use.

Loose connections kept the fuse/breaker from tripping because they couldn't pass enough current to trip/blow, enough to heat things up though. That from Dr. Jerry! But with no ground path there was nothing to trip anyway unless
there was a solid short from hot to neutral. But this also happened with wire run in conduit, too.

The problem with BX might have been the sharp edge at the end of the metal jacket cutting through the insulation, that's why you have to be sure to use the little red anti-short bushings. zzzzzzzzzzt! POOF!

Date: Mon, 06 Jan 2003 15:38:35 -0800
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] RE:

I have never seen any BX or ROMEX in any R-39XXX Hank

From: "Kenneth G. Gordon" <keng@moscow.com>
Date: Mon, 6 Jan 2003 15:39:44 -0800
Subject: Re: [R-390] RE: Wiring...

I'll have to check my code book, but don't you mean that commercial buildings are NOW required to use it WHEN NOT USING CONDUIT, either EMT or rigid? I.e., don't use Romex, but use BX instead?

> Why do whole citys require it?

Looks like Jim Brannigan answered that one.

> Was it an installation problem that caused the fires?

At the time I did commercial wiring, back in the early 1960s, there were enough instances of fires being caused by BX cable that we were forbidden to use it. My understanding and memory is that although the fibre bushings were used on either end, and although the electricians who installed it had cut the BX properly and installed the bushings properly (FIBRE as I said), eventually the fiber bushings would fail, the spiral armored cable would corrode so that the various turns of armor would no longer make contact with adjacent turns, turning the entire length into a spiral heating element if shorts occurred at BOTH ends. I remember one place I was called in to repair in which the holes drilled through the joists and studs were charred from the BX.

> What was the mechanism by which the fires were caused?

See above.

> What is different now that it does not cause fires?

Perhaps different insulation around the wires (ours was tarred paper), different materials, probably hard plastic, for bushings at each end (ours were fibre...compressed paper with glue, I recall), better insulation around the wires, better plating on the armor. etc. I dunno. I haven't seen any new BX cable lately, so I can't compare. And Montana doesn't have rats....at least not in houses...

Date: Mon, 6 Jan 2003 16:32:19 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Some progress

Same up here, Cec, I still use copper for industrial, especially where heat or big loads may be a problem, but all overhead stuff is aluminum, also factor in the weight, 750 copper being VERY heavy. Now, the West Coast may have different problems due to the almost constant west winds off the sea, this may be a concern several miles inland, too. The same not considered on the East Coast, maybe not on the "South" Coast either. North Coast, of course, more problems with ICE loading!

Date: Mon, 06 Jan 2003 21:44:24 -0500
From: "Gregory W. Moore" <gwmoore@moorefelines.com>
Subject: Re: [R-390] RE:

It's called "armored cable", OR, if you just want the outside, Greenfield conduit. Leastways I have been calling it that these many years, BX went

through some changes. First it was the form described by Joe, with the Paper insulation/filler. It went through some permutations of cloth, and other stuff before it wound up with the THHN.

The original "Ground" was the jacket. Then, it was a miniscule (20 or more ga) aluminum wire, or a tinned copper wire. None of these "bonds" were terminated at the main junction box, they usually were (as were the original romex grounds) wrapped around the metal jacket and stuffed into the fitting, or like romex of the time, doubled back over and grounded to the clamp screw. Of course, the panel itself morphed, from no ground other than the service neutral, to a water pipe bond, to having the neutral and bonds on the same bus bar, to (now) having the grounding bonds on a separate bus bar.

There was, in the late '70's a weird period that I would just as soon forget, when some codes wanted you to bring all the bonds back out of the panel, (yes, it was ok to bend romex bonds back over, and bx bonds the same way, wind them together, and terminate them all in either a bug, to a ground cable, leading to the rods, or a huge lug.

It was really unsafe, as there was no way that one could guarantee that they all were, indeed, grounded, or any way to service this mess easily. I was glad to see that go away, but there are still huge amounts of trash wiring out there. Now, I did my whole basement in conduit. It looks neat, protects forever, and is easily serviced. Besides, my shack is there, and I have a 60A load center feeding that separately, which can be shut off, of course, by a safety switch outside the shack, or with a breaker at the main panel.

Subject: RE: [R-390] RE:
Date: Tue, 7 Jan 2003 10:51:22 -0800
From: "David Wise" <David_Wise@Phoenix.com>

We should probably anchor this to the National Electric Code, if anyone has a recent copy. Mine is 1990. Although I must confess I haven't cracked it open for at least five years, I remember that it makes a distinction between flexible conduit you populate with your own wires, and the premanufactured assembly that you cut to length and strip (aka BX). I believe the former is called Flexible Metal Conduit and the latter Armored Cable. FMC is permitted to function as the Equipment Grounding Conductor, but I think you can use a wire too if you want. I've seen AC on the shelf at the local big home improvement place but have never used it. For a given number and size of wires, it's much smaller than FMC, since you don't thread wires through it. As others have alluded, FMC or AC is required in some spots, such as going to a motor or other assembly that might vibrate, or be taken off its moorings for service. I used FMC+THHN

from a box to my furnace. It passed inspection.

From: "Fred L. Haney" <fhaney@inteliport.com>
Date: Wed, 26 Mar 2003 20:41:53 -0500
Subject: [R-390] (no subject)

I had similar problems about a year ago with strong broadband buzz-saw type RF noise with fundamentals below MW band radiating multiple harmonics up past UHF TV frequencies. I also took my Sony SW receiver outside and heard it on the power lines; called the power company who sent a tech specialist, and noise was coming from my house, and radiating to outside power lines !

A wall wart power supply had somehow partially shorted a diode or something, and was resonating the house wiring and L/C loads, acting like a pulse generator. It would come and go at random intervals, with no apparent reason for the trigger. Removed it and never had it again. This can happen to all kinds of stuff: surge protectors, automatic controllers, etc. When it happens, take the portable RX around the house and "sniff" every corner. It helps to have the receiver with you next to the breaker panel and switch off each circuit breaker until the noise goes away, isolating the problem sector location. Then zero in on that part of the house. You will really be surprised what you find. 73, Fred
---
From: "Glen Galati" <eldim@worldnet.att.net>
Subject: Re: [R-390] powerline noise
Date: Wed, 26 Mar 2003 18:03:07 -0800

Hello INTERFERENCE GROUP, For my TWO CENTS WORTH! 400-450 Hertz sounds very unusual. I think a Spectrum Analyzer is in order or a NOISE MEASURING SET. I anxiously await the verdict.

From: "Jim Miller" <jamesmiller20@worldnet.att.net>
Subject: Re: [R-390] powerline noise
Date: Wed, 26 Mar 2003 22:54:09 -0500

Could this be Power Line Comunications (PLC), where data neworks or utility monitoring signals are carried through power lines. I think they operate in frequencies up to 142 kHz, maybe what you're seeing is some harmonic multiple.

Date: Thu, 27 Mar 2003 10:45:59 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] powerline noise

Location of power line noise has had lots and lots of discussion over the

years. I can only recall a small bit of the advice and experience from others:

1) Get and thoroughly read the ARRL publication on the matter. Then read

i

t again.
2) Enlist the help of any radio clubs with experience.
3) Get and use intelligently a small am radio receiver that has a ferrite

l

oop stick inside it.
4) Be persistent, detailed, and thorough in documenting signal levels

around your area.
5) Correlate noise levels with locations, times of day, rain/dry periods

and workday/weekends.
6) Go out at night with binoculars to inspect suspicious poles for visible

arcing.
7) Contact the FCC field office in a polite and cooperative manner to get

more advice and assistance if possible.
8) (Not recommended): use a sledge hammer on wood poles if you suspect

arcing insulators or other hardware.
9) In the meantime, contact N3RFI, who is the FCC field engineer in my area

and a specialist in noise and related matters. (I think that's his call.. I can

c

heck

on that.)
10) If all that fails,

a) use $2400 to buy an Icom IC-709 Pro II super or whatever it is that is

r

eported to knock the socks off of every other radio in civilian existence

f

or noise reduction.

b) dis-enroll from this list to save yourself the grief you'll get from

all of us tube radio owners.

From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] powerline noise
Date: Thu, 27 Mar 2003 19:59:03 -0600

I agree that it is in the Utility's best interest if for no other reason than customer satisfaction...but I doubt the FCC would have anything to do with matters of Power Line noise and am certain that there are no time constraints the Utility is held to. I can tell you that they will usually be willing to help you solve the problem especially if you can try and pinpoint it to a specific pole. It is usually a piece of wire that is used to tie the 13kv Primary conductor to the insulator. When one end breaks loose there is a small arc over that occurs to the tie wire...it creates fairly broadband noise. Sometimes the pole ground breaks loose at the top and causes noise as well. The Utility usually has it's hands full dealing with outage related problems and will consider the noise trouble report a fairly low priority in the grand scheme of things. Try to remember that they have all been "DOWN SIZED" to death and are usually understaffed. (been there-doing that) I know all this because I am a Telecommunications Wireless specialist with the nations largest Public Electric Utility. The easiest way to get in touch with someone that can help is to stop by your local "Service Center", easily spotted by all the bucket trucks going in and out, and ask to speak to one of the division Engineers. Explain what you are experiencing and what you have done to try and locate the source. It may take a few weeks to get someone to come out and meet with you...but when they do show them what you are hearing. You probably won't have much luck calling the number listed in the phone book used to report a power outage. I assume you are hearing it equally well on the portable. Another very common source are door bell transformers. There is usually one in every house on your street and they have a nasty habit of becoming very noisy before eventually failing. (takes years). Above all be friendly and patient....usually they will be willing to give you a hand.... Threatening to call the FCC or the Public Service Commission will usually just get you ignored!

From: "Mark Richards" <mark.richards@massmicro.com>
Subject: RE: [R-390] powerline noise
Date: Thu, 27 Mar 2003 21:16:11 -0500

From the ARRL:

"If someone has exhausted every reasonable possibility at resolving a power-line interference problem with a utility company, they can contact the FCC Call Center and discuss their problem with one of the FCC personnel. If the FCC staff feel that it would be helpful, they can send out their "RFI -- Power-Utility Letter" that explains the FCC rules, explains the possible penalties for violating those rules and asks the utility operator to resolve the problem voluntarily in a reasonable time period." I believe

there is a written limit to their patience otherwise there would be no statutory power available to the commission on these issues. I recall in one case that the utility was completely arrogant and refused repeated attempts at resolution. The FCC letter spelled it out and they jumped into action.

From: "Bruce Ussery" <wa4zlk@acer-access.com>
Subject: Re: [R-390] powerline noise
Date: Thu, 27 Mar 2003 21:18:09 -0800

My particular "horribly high noise level" was mainly below 4 Mhz; sniffed it out using a transistor radio as mentioned in other posts and turning off circuit breakers. Turned out to be a garage door opener. The little remote receiver must have a dirty power supply, and the wiring going to the remote button and safety sensors made a great transmitting antenna. Knocked it down 95% or so with an inductor in series with the remote button wire at the receiver end, and a little cap across the remote button contacts. Don't know the inductor value (random junkbox parts); the cap value was fairly critical - .0022uF comes to mind but would have to check. Good luck.

Date: Sun, 06 Apr 2003 20:09:10 -0500
From: Terry O'Laughlin <terryo@wort-fm.terracom.net>
Subject: [R-390] powerline noise - it's dead, I've killed it!

I want to thank everyone for their suggestions on finding my horrible noise generator. And Dave Maples gets a big thanks for his right on the money suggestion. Today was the perfect day to tackle his suggestion because I had to reset all the clocks anyway.I found the noise generator and it was not some marginal piece of junk. It is a one year old Linksys 100 Base-T, 4 port hub. This thing spent the eight months of it's life three feet from my receiver rack. I'm going to complain to the manufacturer otherwise I'd take it out in the street and drive over it with my VW microbus for the sheer satisfaction of hearing the case shatter. I guess the foil FCC Part 15 sticker was not big enough to do it's job. I am so relieved. I was ready to give up on the SW/MW/LW bands as a hobby. My present QTH is still noisy, but not the S9 to +20 noise I've had for the last year. It really made me wish I was still in the farmhouse in Barneveld, WI set on a narrow ridge of iron bearing sandstone and yielding European LW broadcasters several times every winter (on a 40 meter dipole used as a T no less).

From: "Bob Tetrault" <r.tetrault@attbi.com>
Subject: RE: [R-390] powerline noise - it's dead, I've killed it!
Date: Sun, 6 Apr 2003 18:26:39 -0700

Many of you might not know that 100 Base Ethernet is a spread spectrum signal source with a differential voltage swing of several volts into 100 Ohms, in other words, several milliwatts, with a (catch the big words here) Power Spectral Density ranging from 300kHz to over 65MHz. If there is any non-linearity in the circuitry or the isolation transformers, or the twisted pair wiring, the differential (non-radiative) quality can be degraded into common mode and the CAT5 cabling radiates. Terry just saw BigFoot.

Date: Sun, 06 Apr 2003 22:20:52 -0400
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] powerline noise - it's dead, I've killed it!

Thanks for the heads-up. I use Linksys Routers and their Wireless access point. No problems with noise or RFI while running a KW. I will file this information away for, hopefully never, future use. BTW Linksys was just purchased by Cisco...

Date: Sun, 06 Apr 2003 21:33:14 -0500
From: Terry O'Laughlin <terryo@wort-fm.terracom.net>
Subject: Re: [R-390] powerline noise - it's dead, I've killed it!

In retrospect, I should have suspected the network all along. But I put it in when I was relatively inactive as an SWL and never put two and two together. The CAT-5 wiring stuffed into this house made an excellent antenna for the crud the hub generated. This Linksys unit is definitely defective. I have other Linksys equipment in the house and they all appear to be dead quiet. The defective hub puts out one hell of a harmonic loaded buzz in the 410-430 kHz range.

Date: Mon, 07 Apr 2003 19:48:50 -0400
From: Dave and Sharon Maples <dsmaples@comcast.net>
Subject: RE: [R-390] powerline noise - it's dead, I've killed it!

All: I had a Linksys hub that trashed everything across the HF spectrum. I got a 1-amp linear regulator board (kit mfr beginning with V...can't remember the name but I believe it's German. Vellemann???) and put it in a small box with a Radio Snack 6-volt transformer and such, and set the device to produce what the original switch-mode wallwart produced. End result...NO NOISE anywhere. For the Linksys stuff, and similar, that's an easy fix for switch-mode trash...

From: "Bob Tetrault" <r.tetrault@attbi.com>
Subject: RE: [R-390] powerline noise - it's dead, I've killed it!
Date: Tue, 8 Apr 2003 09:47:56 -0700

Good information Dave, My info with respect to the Ethernet spread spectrum architecture was entirely beside the point, I'd never thought of the Linksys power source: if there's a switchmode wall-wart in your house, replace it with a linear!

From: "Kenneth G. Gordon" <keng@moscow.com>
Date: Fri, 08 Aug 2003 17:04:51 -0700
Subject: [R-390] Re: Noise...(somewhat long)...

> .....I am getting an impulse type noise at aprox 5.2 /sec.....

I have been reading your e-mail describing this problem. Although your e-mails aren't totally clear, to me at least, when you are describing what is going on, I think I can make some suggestions:

1) First of all, you must determine positively that the noise isn't coming from something inside your house or on your property. So, with a battery operated portable radio tuned to the noise go to your breaker or fuse panel and turn off breakers or remove fuses one at a time, leaving them off when you do the next one, until ALL are off, or until you determine that one of the fuses or breakers eliminates the noise. If, when turning off a breaker, the noise goes completely away, trace that out till you find the source. If you still have noise, even if it is weaker, go to the next step.

2) Get a portable radio of some sort with a built-in loopstick antenna. If you choose a multi-band portable radio, keep in mind that the loop-stick is usually only connected to the input stage on the standard AM broadcast band. The rod antenna is the used for the SW bands and possibly for the FM band, so don't use either SW bands or FM band. The radiation pattern for a loop stick is broadside to the loop-stick (in most cases), and there is a fairly sharp null off the ends. You can determine which direction the null is pointing by tuning in a fairly strong local station, which you know the direction to, and turning the radio around on its center axis until that station is nulled. You may have to open the radio up to see what the orientation of the loop is. In some radios it is horizontal near the top under the handle. In others it is vertical to the radio. Tune the radio to a quiet spot in the band (best to do this during the day) and, then, starting in one corner of your property, swing the radio back and forth with the loop HORIZONTAL until you get a null on the noise. The length of the loop will be pointing AT the noise source. Mark the direction somehow. I use a crude, hand-drawn map of my place. Walk to another corner and repeat. Do this for all 4 corners. IFF the noise is on your property, you should be able to get a pretty good idea of where it is coming from.

3) If the results of this "triangulation" technique are either inconclusive, or you find them pointing TO A POINT off your property, you will have to take

things a step further.

4) If you determine either that the noise is coming from someplace OFF your property, or are unable to determine exactly where it is coming from, visit your neighbors and ask them if they have started experiencing noise or static on either their radio or their TV sets recently. Tell them that you are trying to track it down and any help they give you would help both you and them. At this point, I would most strongly suspect a problem with the power company's equipment. Power companies use aluminum wire to connect from the transformer to your house in most cases, and this is notorious for failing. In fact, after reading what you told us, I immediately suspected that the connections from the power line to your panel AT THE PANEL, or the connections at the transformer that feeds your house, or the connections from the transformer to the main power line, are loose and arcing. To fix this, you will have to call your power company, and be REALLY insistent that they come take a look. DO NOT try to fix this yourself unless you are a licensed electrician. I know of at least one incident wherein when the power company opened the pad-mounted transformer door, they found a puddle of molten aluminum on the floor.

In my own case, I had been troubled with terrible noise for a number of years. It would come and go, pulse, get louder and softer. I tried to triangulate it and I found several nulls up and down the power line which follows the street in front of our home, yet the strongest noise was right at our panel. When I turned ALL the breakers off, the noise diminshed, but was still audible. A few months ago, in the process of adding a new bedroom, we had the feed from the pole to our house, the downlead from the roof to the meter base, the feed from the meter base to our panel, and the complete panel replaced with all new parts. We discovered that the cable from the meter base to the panel, AND that from the meter base to the roof jack, AND that from the roof-jack to the pole, ALL of which was aluminum, had never been installed properly, or had deteriorated with age. There were burned or arcing marks under the sealant in several places. Now my noise is completely gone and I can listen in blessed silence.

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] Isolation Transformer update
Date: Thu, 6 Nov 2003 12:36:07 -0500

Don't know how typical that is -- doesn't sound unreasonable. But then, that's why power is switched at the primary .... except for a lot of new stuff. Wherever wallwarts are used, there's a constant drain even when the devices connected to them are turned off. Originally, these were mostly for use with small devices that were otherwise battery operated and mostly on a part-time basis.. However, there are many AC only as well as portable equipment with wallwarts whether they make sense or not. That's so the

manufacturers don't have to design for mains voltage and UL/CSA/CE approval for the unit itself which only "sees" low voltage AC or DC. Also makes it easier and cheaper to provide for various domestic supply voltages by simply packing the appropriate wallwart in the box. Though well forgotten by now (pre-9/11), one of Dubya's early speeches about energy conservation called these things "power vampires" that consume even when not in use. And that's because the primary is connected 24/7. Look around -- most computer accessories, even tabletop communications receivers, cordless phone bases, you name it. Probably average about 10-20 of these things per household. Leave 'em all plugged in, turn everything else off, then go read your meter. I suppose it can add up. (Touch some -- see how warm some of them run on idle.) While most of the wallwarts have some kind of approval marking, most all have no internal fuse or thermal breaker. If they fail, most will begin to burn up well before tripping a 15 or 20 amp breaker. Gettin' old here. Just mention something about primary windings drawing current with no load .. and I run off at the keyboard on a wallwart rant. Don't you just love the ones that don't have the manufacturer's name or model number, so when you disconnect a bunch .... nevermind. I'm starting to sound like Andy Rooney.

So you were saying? 350 ma unloaded? Don' t look know but .... ;-)

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Isolation Transformer update
Date: Thu, 6 Nov 2003

I agree. I don't like to leave wallwarts plugged in unless it is for something needful like charging the cordless phone, etc. As far as this 1KVA isolation transformer is concerned, everytime I try to hang it on the wall, it falls out of the recepticle. :) Seriously, the isolation transformer will only be switched on when the shack is in use. Everything goes dark when I leave the shack for the evening. Too many things to worry about out there that a single flip of a big switch doesn't take care of.

Date: Sun, 02 May 2004
From: Buzz <buzz@softcom.net>
Subject: [R-390] Line Noise

I had a line noise problem that I thought you might be interested in.
http://www.softcom.net/users/buzz/temp/Linenoise.html
I hope that my experience might help some one else.

From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] Line Noise
Date: Sun, 2 May 2004

Buzz, The waveform is a classic SCR switching waveform, as from a cheap light dimmer. If the load is large enough, it doesn't have to be in your house. The SCR turns on in the middle of half a line cycle, causing the maximum very fast increase in voltage across the load. Glad to hear you could fix it so easily.

Date: Mon, 25 Apr 2005 13:49:03 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] R390 power cord

>... I'm in the habit of acquiring the pc-type power cords and cutting the female end off

Dan, Good plan.

>... First question: is this wire size big enough?

Yes.

>...Second question: Should I connect both the covered green wire and the uncovered wire to the radio ground at the radio?

Yes.

>... I assume the purpose of the uncovered ground wire has to do with contact to >the metal sheathing (shield) around all the wires. Dan.

Yes. It's called a drain wire, and is the best way to make contact with the foil shield. You may notice that the jacket markings include the word "Shielded". Only some computer type cords have this, and the ones that do seem to be thicker than the ones that don't. I use them on receivers, even if the receiver has line bypass caps installed (or a line filter as the R-39x radios do.) I was poking through a box of such cords recently, and it's my impression that cords can be grouped by thickness as follows:

18/3 no shield

18/3 with shield

16/3 no shield

16/3 with shield

Please check with an ohmmeter the line and neutral connections. Note: the LINE connection in an outlet is narrow. The Neutral connection is wide. The Safety ground connection is round. (In a three wire line cord, the

flat blades may both be narrow. In a "Polarized" two-wire line cord, one is wide. Here's color code information from a message by Bob Nickels

"...For years, the colors of individual conductors in cords for use in North America have been black for line, white for neutral, and green for earth (ground). But in order to harmonize worldwide standards, two major UL equipment standards, UL 1950, Information Technology Equipment, and UL 2601, Medical and Dental Equipment, started several years ago to require the more traditional European conductor color coding: brown for line, light blue for neutral, and a combination of green and yellow for ground. The color conversion is as follows:

LINE (US) Black = (EU) Brown
COMMON (US)White = (EU) Blue
GROUND (US) Green (EU) Green/Yellow ..."

As you replace normal line bypass capacitors, do not put them back one each from line and neutral to chassis, put them as follows:

One from Line to Neutral
One from Neutral to chassis.

Complete, longer diatribe on line cords and bypassing supplied separately to anyone who requests it.

Date: Mon, 25 Apr 2005 15:30:22 -0500
From: "Don Reaves W5OR" <w5or@comcast.net>
Subject: RE: [R-390] R390 power cord

Roy, I think you should post your entire line cord diatribe right here on the R-390 list. Not everyone who needs the info is going to request it from you, but safety is a big concern, or should be, with those of us new to vintage gear who are used to dealing with modern non-lethal (<12VDC)* radios.

I frequently remove hacked on power cords to vintage military equipment, usually because the original cord was missing and the proper connector wasn't avaialble. It amazes me how many have the polarity wrong, aren't fused, and have no safety ground. And that doesn't begin to describe the bad stuff I see with old consumer type AC-DC BC radios. Yikes.

Date: Tue, 26 Apr 2005 11:17:13 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: [R-390] Power Cords and Bypassing: Roy's Diatribe

Ok, folks here is the info I have written/collected on power cords and bypassing. Some notes are in order:

1) The R-39x line filters have multiple capacitors from both sides of the power line to chassis. They act like voltage dividers IF the chassis is not properly grounded and you get about half the line voltage on the chassis. This does NOT mean that the caps are "leaking" or shorted - they are simply acting like capacitors. The R-390/URR line filter has more caps in it than the R-390A/URR one does.

2) Replacing the original line filter in R-39x radios with a modern "computer type" chassis connector with filtering may be a good idea if you have ground fault detectors in use. The AC current bypassed to the safety ground (chassis) from the original R-39x line filters can trip these devices. A simple metal plate can be made to replace the original line filter and mount the new line cord connector.

3) I have included one source for appropriately rated line bypass caps. They also have info on these caps that is worth reading. In case you are replacing or adding bypass caps to your equipment, I suggest you follow that link and use modern properly rated caps.

4) I have the following available as separate documents:
- The "imaginative but quite serious descriptions" of how your wife can be come a widow

mentioned below.
- A diatribe on the dangers of Variacs and what can go wrong when you "bring the radio up

s

lowly".
- Info on reforming electrolyitc caps and testing smaller ones for leakage.

5) Corrections and opinions welcome. Thanks.

Roy's Diatribe on Fused Line Cord Plugs and Line Cords and RF Bypassing
powercordsandbypassing.txt
From k1LKY
Fused Line Cord Plugs:

Under no circumstances should you ever use a fused line cord plug, period. It can kill you in a variety of ways. The Johnson company put them on Rangers, Valiants, and other equipment. I have a Heath VHF-1 6- and 2-Meter transmitter with one on it. These line cords and fused plugs are the first thing to go when I start returning it to serviceable condition. Note that there seem to be two applications for fused line cord plugs: Electric fence energizers and decorative electric holiday candles and light strings. The electric fence situation is based on long history, and safety may well

rely on the idea that the case of the energizer is grounded with a ground rod to make the fence work properly. The window candles and light strings have no chassis, no switch, no transformer, and very little exposure of energized conductors to people. Some time ago I wrote imaginative but quite serious descriptions of some of the many ways fused line cords can make a widow out of your wife. These are not included here. In summary, however, the way your wife gets to be a widow is as follows:

1) The equipment with the fused line cord plug suffers an internal short such as in a transformer

or RFI bypass capacitor, with the short circuit more or less to the chassis.

2) ONE of the line cord plug fuses blows (almost never will both blow unless the fault is a dead short.)

3) You unplug the thing, unhook the "good station ground" wire and antenna, move the radio to a work bench to figure out what is wrong. Notice that the ground you *might* have had on the chassis is removed.

4) You plug it back in and unknowingly insert the unpolarized plug so the intact fuse puts line voltage on the chassis.

5) You reach for the power switch, the current kills you and your wife becomes a widow.

This is a topic sure to generate much traffic on any radio mailing list. People's attitudes seem to fall into four groups:

1) "Problem? What problem? There's no problem here." Duuuhhhh!

2) "Originality forever!" To hell with the fact that it may kill me or someone else, I will use

t

he original fused line cord and my equipment is authentic.

3) "Hmmm..." I'm glad to know about all this (but I may not DO anything to prevent my death

or that of any other hapless and innocent person.)

4) "But of course!" Safety in line cords is easy to understand and worth paying attention to. I'm going to get busy and fix this situation now.

Be safe, live long. Do not use fused line cord plugs.Install a three-wire grounded line cord, and make sure your outlets are working right.

Line cords and how to install one safely:

(in US standard line cords): GREEN is safety ground, and should be tied directly to the chassis. In European (IEC) cords, the safety ground is Green/Yellow.

BLACK is "hot" or "line" - it goes directly to the rear of the fuse holder, the terminal farthest from the outside of the fuse holder where the cap is installed. The terminal on the fuse holder nearer the chassis or panel goes to the switch and should go nowhere else. (See info on bypass caps below.) If you use an open clip-style fuse holder under the chassis, use either end of it.

WHITE is "neutral" and goes UN-fused to the system, e.g. power transformer primary. Do not put a fuse in both power cord lines. This can lead to a dangerous situation, though it's less likely to be dangerous with a three wire grounded line cord than with the deadly fused two-wire un-polarized line cord plug.

On the line cord wall plug,
- the round, longer pin is green
- the larger flat pin is neutral
- the narrower flat pin is line or hot.

(beginning of extract from message by Bob Nickels)
From: "Robert Nickels" <w9ran@oneradio.net>
Subject: [Johnson] Fused Plugs
...
A good source of replacement 3-wire power cords are those used by computers and peripherals, but most of them use the European color designations for years, the colors of individual conductors in cords for use in North America have been black for line, white for neutral, and green for earth (ground). But in order to harmonize worldwide standards, two major UL equipment standards, UL 1950, Information Technology Equipment, and UL 2601, Medical and Dental Equipment, started several years ago to require the more traditional European conductor color coding: brown for line, light blue for neutral, and a combination of green and yellow for ground.

The color conversion is as follows:

LINE	(US) Black	=	(EU) Brown
COMMON	(US)White	=	(EU) Blue
GROUND	(US) Green		(EU) Green/Yellow

(end of extract from message by Bob Nickels)

Older HP and other test equipments were equipped with an oval line cord connector and matching cord. The Belden/Volex 17280 power cords are apparently the normally-connected cord.. There is a version with reversed line and neutral. In all of them, the offset (center) pin is chassis ground. When working with these equipments and line cords, do take time to sort out hot from neutral so you retain the safety aspects of the fuse connection.

RF Bypass caps should be installed as follows:

One from Line to Neutral, after the fuse.
One from neutral to chassis.

When our boatanchor equipment was made, it was common to use both a two-wire, ungrounded line cord and two bypass caps, one from each side of the line to the chassis. Do not re-create this situation when you install the three wire grounded line cord. This causes a danger of fire should the line to chassis cap short but not draw enough current to blow the circuit breaker, and this arrangement also causes the chassis to be at half the line voltage if the safety ground is not present (such as in a two-wire outlet used with an adapter, or in an outlet improperly wired or faulty.) There are currently available "Safety" capacitors meant for line bypass applications. You can tell them from normal caps in the catalogs because they cost about 5 times as much as normal caps. If you take apart computer power supplies or junk TV sets, you will wind up with one or two from each unit. A reasonable review and discussion of caps used in older radios and line bypassing is at:http://www.justradios.com/safetytips.html ABC's of SAFETY Capacitors for Tube Radios They do fail, however, to discuss the method of installation above. The authors are in Canada and offer a number of services for old radios, including technical information, and capacitors. Here is their capacitor page:

http://www.justradios.com/capacitors.html

You can also find the same kind of capacitors at Mouser and other large parts suppliers.
Fuses:

The topic of fuse installation and choice of fuse type and rating is a complicated one, but here are some points to consider:

1) For normal equipment, put one fuse only, in the Hot wire of the line cord as near as practicable to the point where the line cord enters the equipment. The black, Hot wire of the line cord should run directly to the tip of the fuse holder - see part 2 below for more details. In equipment such

as the Valiant transmitters that are made with extensive RFI filtering on all leads exiting the case, you may not want to add a rear chassis skirt mounted fuse holder. In other radios that never did have a fuse, such as the Hallicrafters S-20R, adding a fuse holder would ruin the originality of the set. In these cases, mount an open fuse clip below the chassis, possibly using an existing screw or transformer mounting bolt. Some military equipment was built with a fuse and possibly a switch section in both wires of the line. This was done where the equipment was to be used aboard ship or in other places where the power circuits were floated from ground for safety and reliability reasons. (This situation also applies generally in Sweden and some other European countries.) If the equipment is in good condition you can leave it as it was built but make sure you have a good three wire grounded line cord and that your outlet grounds are properly connected. Note: the three-terminal MS series, "Amphenol" type connectors used by the military on such equipment as the CV-591 and CV-89 were installed with (at least) two different pin arrangements.. Be very careful that you dope out what you have when working on equipment of this sort. Mis-matching the cord to the equipment could lead to trouble.

2) The Hot or line wire of the power cord goes directly to the rear of the fuse holder, the one farthest from the outside of the fuse holder where the cap is inserted. The terminal on the fuse holder nearer the chassis or panel goes as directly as possible to the switch. This reduces to the absolute minimum the amount of conductor inside the equipment that is not protected by the fuse. And it reduces the chance of a shock when you are installing or removing the fuse if the line cord is still energized.

3) The "cold" or neutral side of the line cord should NOT be fused. The Green, safety ground wire should never be fused. Also, the safety ground should not pass through any connector other than the line cord connector and should not pass through any printed circuit path. It should be connected directly to the chassis.

4) Follow manufacturer's specs for the type and rating of the fuse. Beware of low voltage fuses that may fit the fuse holder you have. Fuses rated at 32 volts may not properly protect you and the equipment in normal line voltage situations. If you don't know the current rating needed, make a guess at the rating and use smaller and smaller fuses until they blow from time to time.. then increase the fuse current rating a bit.

5) "Inline" type fuse holders can be used under a chassis with no holes to drill or screws needed to hold down an open style fuse holder. They come in two sorts, apparently. One sort is just like a panel mount fuse holder but has no mounting nut and no external solder connections. Wires enter the cap on one end and the holder body on the other end. The other sort is rounded and fastens together in the middle. This link shows both types and

has them for sale:
http://www.members.tripod.com/ralph_graves/littlefuse.htm

GFI and Hot Chassis Troubles:

The R-390 series of receivers, among others, was built with robust line filters. The R-390/URR filters have more caps in them than the R-390A/URR ones do. The arrangement of the capacitors places half the line voltage on the chassis if the chassis is not grounded. This is NOT because the line filter capacitors are leaking or shorted, it is normal voltage division behavior of the circuit as installed. If the chassis is grounded, enough current flows in the safety ground wire to unbalance the two line currents and trip many ground fault interrupter devices. Old style methods of bypassing both wires of a two-wire line cord to the chassis can do the same things. Steps to correct these troubles include:

1) Remove the line filters or line bypass capacitors connected in the old style and either leave them out or install bypasses as above.

2) Use an isolation transformer or a "Sola" type constant voltage transformer (most of which have isolated secondaries). Note: most "Variacs" or variable voltage transformers do NOT provide any isolation. Some that do apparently exist but they are rare. Further, fuses in these things may be in the input wire only and not in the variable voltage output wire. This can lead to overloading the low voltage turns of your transformer. Both input hot and output hot should be fused, or at the least only the output wire.

3) Use properly grounded three wire line cords with non-GFI protected power circuits.
Outlet Safety Testers:

Most home stores and electrical supply houses can sell you a small gadget to test your outlets with. They have a number of neon lamps that indicate proper functioning or various fault conditions. The cost is less than $10 and is one of the best investments in your safety you can make. Even "licensed professional electricians" can and have made mistakes wiring up houses, and time and wear can open up safety grounds that were installed properly in the beginning. You owe it to yourself, your family, and later occupants of your house to buy and use one of these very helpful gadgets.

Think safety.
Install proper grounded line cords.
Live long....
(end of diatribe)

- Roy Morgan, K1LKY since 1959 - Keep 'em Glowing!
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roy.morgan@nist.gov --

Date: Fri, 01 Jul 2005 10:21:00 -0400
From: Dave or Debbie Metz <dmetz@ntelos.net>
Subject: [R-390] OT? Dimmer buzz, solution?

While this is probably not within the parameters of heavy iron, I do have a question for the collective wisdom of this esteemed group. I have been haunted for years by lamp dimmer buzz radiated as RF that gets picked up with my basement hobby an the AM that the R-390 wants to hear. Recently, I purchased a Lutron Lamp Debuzzer Coil LDC-10-TCP in another attempt to eliminate this radiated hash. Low and behold the $110 investment worked fantastically! Now what I want to know is how to build such an animal for a lot less than $110! All there is to this is a box about the size of a smaller ballast transformer with two wires. It goes in series between the dimmer and the light load. They have very specific amperage ratings , 400-600 watts, 600-1200 watt, and 1200-1920 watts depending upon the needed load range. It sure is great to now have the XYL upstairs watching TV with a dimmed light and I can listen to the DX BC band on the 390! There has to be a cheaper solution for the rest of my dimmed light circuits.

Date: Fri, 01 Jul 2005 11:30:08 -0400
From: JMILLER1706@cfl.rr.com
Subject: Re: [R-390] OT? Dimmer buzz, solution?

http://www.lutron.com/applicationnotes/360484.pdf

It is probably a pair of high-Q coils, such as a toroid, in series with each line that will handle the AC current, combined with filter capacitors across the line and to ground.

Date: Fri, 01 Jul 2005 11:32:09 -0400
From: JMILLER1706@cfl.rr.com
Subject: Re: [R-390] OT? Dimmer buzz, solution?

Also check out this:
http://www.ethanwiner.com/dimmers.html

Date: Fri, 01 Jul 2005 11:37:30 -0400
From: JMILLER1706@cfl.rr.com
Subject: Re: [R-390] OT? Dimmer buzz, solution?

Sorry for the duplicate posts, but here's one more idea: Get the ARRL RFI Handbook. Apparently it has circuit designs. See http://lists.contesting.com/archives/html/RFI/2000-09/msg00015.html

"> (b) I need to know how to modify a light dimmer switch ..... <snip>

Light dimmers & speed controllers as well as touch lamps both benefit from the use of brute force AC-line filters and ferrites added to the lines. But they don't always work. Sometimes you need to replace the devices with quieter one that has built in RFI suppression. The ARRL book recommends the AC filter and ferrite approach, using an FT-240 or FT-140 sized core with about 15 turns on it. I think 43 mix material for HF/VHF noise and #75 or 'J' mtrl for lower HF noise should be used. It may take two cores to get the noise down low enough, but then you run out of AC line so an electrician may be needed to install additional wiring. Also on dimmers you may need cores on the input and output. In the case of touch lamps, especially ones radiating, a 1-4 Kohn resistor and a 10 microHenry choke on the sense line may help as well..Again, do these mods at your own risk or have an electrician do it to reduce your liability. I've also found that plugging these lamps into different outlets makes the noise less resonant on some freqs and more on others. If your lucky, it'll move to a non-ham freq!

Date: Fri, 01 Jul 2005 12:30:43 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] OT? Dimmer buzz, solution?

<snip> Smash it open and see what's inside. Go to Mouser looking for similar parts. Buy parts. Put together with a bit of heatshrink and be done. Estimated cost: five bucks MAX.

Date: Fri, 01 Jul 2005 12:37:35 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] OT? Dimmer buzz, solution?

>Also check out this: >http://www.ethanwiner.com/dimmers.html

which page includes the following: "lthough many low-cost power outlet strips sold at hardware and computer stores claim to include RFI filtering, in truth none of them contain filters that are really effective. You need to purchase a genuine industrial-grade RFI filter from an electronics parts supplier. Both Mouser (mentioned above) and DigiKey (800-344-4539; on the Internet <http://www.digikey.com>http://www.digikey.com) sell the kind of filter
I'm talking about here. I have used filters made by Corcom (sold by

DigiKey) and Cornell-Dubilier with great success, and they range in price from $25 to $65 each, depending on their capacity in Amperes. Don't waste your time with cheaper units; buy only Series R two-stage L-C (inductor-capacitor) filters. "

Date: Fri, 1 Jul 2005 13:55:38 -0400
From: "Jim Miller" <jmiller1706@cfl.rr.com>
Subject: Re: [R-390] OT? Dimmer buzz, solution?

You may only need to get a better quality dimmer, the ones in local stores (for $10.00 or so) will probably not have superior RFO filtering built in....The Lutron Nova series ($25 price range) has excellent filtering built in. I use them here.

From: http://www.arrl.org/tis/info/touchlamp.html

"The Lutron NOVA series uses toroidal chokes that provide a significant level of RFI suppression.I bought a Lutron model N-600, which will handle up to 600 watts of incandescent lighting. Temporarily installed in my radio shack, a generic light dimmer produced an S9+ reading at 230 kHz (an arbitrary noisy frequency). The N-600 produced a reading of S3, a difference of about 40 dB. Admittedly, this is not zero, but installing the N-600 some distance away provided a reduction in RFI that is very gratifying. Indeed, I now hear new noise sources, heretofore undetectable through the dimmer din. You're not likely to find these dimmers at your local discount store, and they are not inexpensive. Check for the availability of these dimmers at a lighting fixture store and expect to pay about $25 apiece for them. "

I had to order mine from an internet supplier. Be sure to specify the "thin" or low profile model. You are not likely to find them in local stores with good filtering.

Date: Fri, 01 Jul 2005 15:41:56 -0400
From: Dave or Debbie Metz <dmetz@ntelos.net>
Subject: Re: [R-390] OT? Dimmer buzz, solution?

Actually, I have a Lutron IR remote control dimmer already installed. While I am not sure if the remote control unit does or does not have the toroidal filtering, it was about $30, so not cheap. However, that is something to call lutron about next week. As far as hacking into this unit, not sure I want to do that. First, it works great, and is of course UL approved. Somehow , cutting it apart on a bandsaw might void that approval rating. I assume that this is something one could make from available parts from Mouser but I just was hoping to get a point in that direction without tearing this apart. What is also haunting me is that

there is no ground requirement. Given that this is in series with a hot leg, it had better be well insulated to the case. Maybe the experts here can help me with that understanding. Next week I will order a non remote Nova series 600 and see if that also has the desired reduction in the hash. Thanks!

Date: Fri, 1 Jul 2005 18:22:02 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] OT? Dimmer buzz, solution?

These lamp dimmers come in two flavors: those with lots of RF trash and those with less RF trash. You can use a SCR and have lots of trash. Or you can use a TRIAC and have somewhat less RF trash. Using a TRIAC will not ensure that you do not get lots of RF trash. To get lots of RF hash and trash turn the power on in the middle of the cycle and off at the zero crossing point. SCR perform this way. TRIAC's may also be operated this way. To get less trash and hash turn the device on some where in the middle of the cycle and off as the device goes through zero crossing. Needless to say a comparator to turn the device on in mid cycle and off at zero crossing is more expensive than the cheap devices. OK a challenge to all. IF you have a quite one that you like, open it up, and post the part number and manufacture here for everyone. If you have a noisy one please post that part number and manufacture here also. We can avoid buying one of these. Sort of a consumer report best of dimmer product if you will.

Date: Fri, 7 Oct 2005 19:31:25 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Power Cords on eBay

Mostly we just put a three wire cord on the receivers. Bond the green wire to the receiver frame. likely with one of the screws used to hold the cover plate over the hot post where the white and black wire get attached. Use a meter and determine which wire goes to the off/on switch and put the black wire to it. Most of us do not use GFI breakers as these get upset with the leakage currents.

The real task is to ensure the third wire in the power receptacle really goes to ground and will hold the chassis close enough to ground so that when you grab a knob you do not get bite. This works OK on receive and on the bench. If you transmit, you better have a much better ground than the return line to who knows where on the power cord. Back when, we accepted nothing was ground. You bonded your receiver with a nice chunk of 1/4 braid. On the bench, in the rack, in the van, You always went looking for the ground before you went looking for power. You can drag the generator to the ground rod, but you cannot always get a ground rod in the ground. Find the ground first. Roger KC6TRU

Date: Fri, 07 Oct 2005 19:52:15 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Power Cords on eBay

Truth be told, there are an awful lot of grounded outlets that aren't grounded or not grounded well enough. My place was built in the early 50's -- complete with 60 Amp service -- four 15 A glass fuses. Two conductor "Romex" throughout. Of course, the old two-conductor outlets wear out and there's nothing but grounded ones available as replacements. Wall plate screw? "Gem box"? Forget it. The service was upgraded two or three times and eventually the kludge of
separate fuseboxes was replaced by one big fuse panel -- 200 Amp service. Any new wiring is grounded, but upgrade the old? Quite a tall order -- can't use the old Romex to pull through -- it's stapled and trapped all along the way. Run new? - Have to tear up the walls -- they are full of "cats" -- and not the white meat meow kind. (16" horizontal 2 X 4's between the studs).

So, fact is, if you have to run separate grounds anyway, and that ground lug on the power plug wouldn't do anything anyhow ... no big deal if it's a two wire cordset with a separate ground-wire -- the ground wire can go to lug attached to a good outlet strip and the 3-prong outlet strip into a good grounded outlet. Or, if the ground's no good on the outlet, I suppose a separate ground line.

The builing I rent for my business is not much better. Commercial code here calls for only two-conductor BX cable (armored). The metal jacket on the BX clamps to the Gem boxes -- supposed to be metal not plastic here. Then the ground lug in the receptacle is connected by means of the mounting tabs on the receptacles. Of course, BX armor is made of one of the most conductive
metals known to Man, the clamps in the Gem boxes are gold plated and the screws on the receptacle tabs never get loose. Uh..huhhhh.

It's a funny thing. The Earth is the biggest thing we got going -- 24K milies in circumference -- plenty of it wherever you go (OK a lot of it is under water), but when you want a good chunk of it hooked up to the other end of a piece of wire ... you have to drive a copper clad stake 10 feet into it -- and keep it wet.

Back in the 50's they didn't have the same ideas about grounded power cord sets. Of course, hot chassis were also popular in the spirit of "we don' need no steenking transformers". Barry

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Date: Sat, 08 Oct 2005 07:58:48 -0400

From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] Power Cords on eBay

> Commercial code here calls for only two-conductor BX cable (armored).
> [...] Of course, BX armor is made of one of the most conductive metals
> known to Man, the clamps in the Gem boxes are gold plated and [...]

I had a small, um, disagreement with local inspectors on this issue a few years ago. We had run a separate ground wire inside flexible conduit because we explicitly did not trust a daisy chain of conduit-box-conduit-box connections (it was EMT, so the "connection" consisted of nothing but a set screw.) The inspectors told us we were not allowed to run a ground wire. Eventually, after going up the food chain and across the county, we got permission to run the ground wire (bonded at every box and to every outlet), but it was a lot of pain and effort to do it the right way.-

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Date: Sat, 8 Oct 2005 10:49:41 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Power Cords on eBay

Hmm, you crashed into a tough one. You might have inquired about "isolated" grounds and "dedicated" grounds. Also, I got into a big "discussion" about HOW the boxes got bonded, the lead electrician read it to mean that each ground wire was to be attached to the box separately, with it's own screw. Not so! All grounds in each box will be tied to the box with ONE screw. That way the box is bonded but the steel of the box isn't part of the ground path.

Date: Tue, 14 Feb 2006 20:12:12 -0800 (PST)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Electrical safety leakage

Roy Morgan wrote: There is a specified leakage limit for medical equipment Having done those tests for 25 years I think I remember the values. There are 3 tests performed.

First is a ground resistance check from the instrument to the power plugs ground pin. The limit is 500 miliohms. Normally you could easily get between 85 to 100 miliohms. Anything close to the limit indicated a loose ground connection. Equipment with the IEC removable plugs was the biggest problem the constant removal of the line cord caused you to have to twist the ground pins slightly to meet specs. This shouldn't be a problem with BA's
as they are almost always plugged in.

The second test was in two parts. You measured ungrounded leakage with

the power turned on. Once with normal polarity and then with reverse polarity. The leakage current limit was 500 microamps. Except for very large pieces of equipment the normal range of leakage was 80 to 150 microamps. This is the rational for the 500 microamp limit. The least amount of AC current that was able to put the human heart into ventricular fibrillation by direct application
was 200 microamps. Since the body is a big salt water sponge, the decision was made to codify the limit as 500.

Beginning of safety rant!
IMHO one is foolish to leave the original line filters on the R39XX, SP 600's and any other BA equipment. The price for new or used "medical grade", I.E. low
leakage, is less that half the price of a 26Z5. I've been "bit" badly by a 2 wire line cord SP 600 when I touch something grounded. NOT FUN. The difference between nasty words and DEATH is the moisture on the surface of your skin. A 4,000 to 5,000 microamp leakage can kill you with no problem. Another reason to use the newer Pi balanced filters is that THEY HAVE BETTER SUPPRESSION
CHARACTERISTICS THAN 50 YEAR OLD CAPS. Hide a new filter in the old case if you want.If you vehemently disagree, have your will, life insurance, final
arrangements up to date and make a value list of you BA stuff so you heirs don't get ripped to badly on epay. You are never lucky forever. In addition, one should make a shorting stick for your RECEIVERS using a 10 K ohm 5 or 10 watt
wirewound resistor. One, your bleeder resistor may not really be working well (if it's even there!) and newer caps, both electrolytic and film capacitors have
MEMORY. They can come back to bite.

When I was in "sets" (hands on: live power) at Keesler AFB I was one of the students who some of the most "sparks". But I never got hurt because I kept one hand in my pocket and didn't wear a ring even though I probably had the sweatiest hands. Heck, my hands are getting sweaty just writing this remembering the past. Be safe, live long. Enjoy our temporary
custodianship. End of Rant Regards, Perrier

Date: Sun, 23 Apr 2006 15:12:04 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] R3 GFCI clarification

>.....If the radio continually trips the GFCI .....<snipped>

This is a good point well taken. This is being added to the safety section. This was my line of work for 25 years so it is learned facts, not an opinion.

Additional Safety Section

Here becomes the first of problems you will face. A properly grounded R390 with the originally installed line filter that is perfectly functional will trip the standard USA GFCI protected circuit. It does this as the filter design passes a little more than 5 mA. to ground and the GFCI trip current is 4 mA. GFCI protected circuits are a NFPA mandatory electrical code requirement in new or remodeled construction for a number of years now in the USA. In most areas requiring electrical inspection, it is law. If the receiver is operated on 220 volts, the current leakage doubles. You have several choices. One is to use an isolation transformer. A second is to remove the original filter. This is not a particularly good plan as the original filter provided EMI protection. The third choice, which most chose, is to use a modern computer power supply filter or an equivalent type low leakage filter mounted inside the chassis. Danger: Under no circumstances should you operate the receiver without a proven good ground wire attached properly to the frame GND terminal 16. "Electrocution" is a bit of a misnomer that isn't self explanatory. In most cases is actually death caused by the heart rhythm being interrupted by 60 cycle current. This is called ventricular fibrillation. The heart is still beating but the four chambers are not in synchronization so blood is not pumped through the body. You may still be breathing more or less normally. In this process you black out and in 3 to 4 minutes your brain dies due to lack of oxygen. Depending on the moisture of your hands, the quality of the alternative ground circuit, the leakage through an ungrounded R390A with its original filter going in one hand and out through the other (worst case scenario) has a very reasonable chance of killing you without blowing a fuse or circuit breaker.

Danger: A variac is an adjustable auto-transformer and does not provide any current leakage isolation. Proven ground. This is beyond scope of this manual. Check with published references such as NFPA or equivalent standards.

Date: Sun, 23 Apr 2006 16:27:28 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] R3 GFCI clarification

When I wrote that safety section I considered the situation as Perry has stated here. We have to stop somewhere or we'll be re-wiring the whole house! I had to assume that the house wiring was correct and up to date,.... not a good thing to assume as I have torn out some very scary wiring in houses where the owner should have known better! I suggest leaving it as written, the radio "should" be TESTED on a GFCI protected circuit, if it holds fine, if not then look at the filter and start troubleshooting from

there. That's all I was saying, that's what I wrote. Reading the safety section as a whole you'll see that it was considering an unknown radio, that is, what to do first. It also expects some knowledge of electricity and electronics, if that isn't there then maybe the reader should get some more experienced help. This radio and this entire subject isn't for the beginner nor is this manual to be considered a basic primer to the subject. No, it should have been written purposely confusing to someone who doesn't know the basics to encourage primary study elsewhere. Like having the GFCI trip out and not explaning why. Leave it like it is.

Date: Mon, 24 Apr 2006 11:26:27 -0500 (EST)
From: <w9ya@arrl.net>
Subject: Re: [R-390] R3 GFCI clarification

Um...not fine at all. If the (stock) filter does not trip the GFCI circuit then you do NOT have a good ground hooked up to the radio. This is to be considered unsafe in certain instances. i.e. It can kill you. If you got nothing else out of the exchanges so far on this topic, understand at least this. AND....fix your grounding situation for sure. Now I will go crawl back into my hole.

Date: Mon, 24 Apr 2006 12:47:02 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] R3 GFCI clarification

That said, you also have to blame the correct item when the GFCI trips. The fault is not a "bad" line filter in the 390A. A "good" line filter in the 390A is guaranteed to trip a GFCI that's operational if you've got a good ground.

> I suggest leaving it as written, ...<snip>

Again, flawed advice. Don't tell somebody to "fix" the component that trips the GFCI when the component is behaving as designed. Yes, the GFCI tripping is drectly related to the line filter. But here it indicates that the line filter is working as designed!

Date: Mon, 24 Apr 2006 10:04:18 -0700
From: "Ziegenbein, Randy" <rziegenbein@volcanotherapeutics.com>
Subject: RE: [R-390] R3 GFCI clarification

One question... Why are people plugging their boatanchors into GFCI circuits? The only circuits in my house with GFCI breakers are in the bathroom and outside outlets. Are you guys using your R-390's while soaking in the tub?

Date: Mon, 24 Apr 2006 10:09:05 -0700

From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] R3 GFCI clarification

I balance my R-390/A on my knees while playing with the rubber ducks. Doesn't everyone?

Date: Mon, 24 Apr 2006 13:10:26 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] R3 GFCI clarification

Every thing in my basement has to be on a GFI circuit. My whole radio shop is in the basement.

Date: Mon, 24 Apr 2006 13:13:13 -0400
From: Rbethman <rbethman@comcast.net>
Subject: [R-390] R3XX GFCI Issues

The real REALITY in our shacks is that we MAY HAVE NO CHOICE but to run a separate circuit for OUR R-3XXs! We ALL know that the filters installed leak JUST enough to trip a GFCI protected circuit. So wholesale changing the filtering is NOT the proper method of "FIXING". IF the filter is up to spec, leave it in place to do ITS JOB. Take a HEALTHY look at shack circuits. Put one in place that is NOT GFCI protected OR use an isolation transformer methodology!
AND for Lord's sake, INSTALL A VERY GOOD and HEALTHY ground system with EVERYTHING grounded!

I have four, (4), copperweld rods outside the shack, all connected with 1/4" bare hard copper clamped AND soldered to the rods. This has been brought into the shack in ONE CONTINUOUS RUN that is attached to a 2" x 12" x 1/4" copper bar. All equipment in the shack it tied to the bar with a MINIMUM of #10 AWG. DO IT RIGHT! If you don't. YOU may be the next SK!

Date: Mon, 24 Apr 2006 13:14:14 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: RE: [R-390] R3 GFCI clarification

Good question. In my case, the shack and bench are in the basement, and electrical code requires that the basement outlets be protected by GFCI. This was not the case just a few years ago (well, not that long ago GFCI's didn't exist at all.) The most recent code revisions add arc-fault interrupters too... gets complicated! While others here emphasize the added safety of testing equipment while on a GFCI protected circuit, I tend to agree with you: it adds a complication that (especially with the Y2K safety text) can confuse a newbie into making things more dangerous. Witness a

couple of posts here in the past couple of years where people say "I had to remove the ground from my radio to stop it from tripping the GFCI and now whenever I touch the chassis I get this big tingle".

Date: Mon, 24 Apr 2006 13:25:26 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] R3 GFCI clarification

You are obviously ill-equipped. Get an R-392. They float. Unfortunately, they float controls side down. Maybe you could get a snorkel and face mask. Maybe you could get some floatation thing to keep it upright. <snip> PS: I view the horse being beaten from a distance and have thus far avoided comment on the line filters sometimes passing 3 to 6 ma of AC current, and that GFCI's sometimes are *rated* at 5 ma current differential, and that some folks have houses where basement outlets are GFCI protected one way or another, and also from telling diatribe type stories on how a fused line cord can make a widow out of your wife.

Date: Mon, 24 Apr 2006 14:16:08 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] R3 GFCI clarification

<snip> It's a known fact that the line filters, even when working right, will trip a GFCI. My understanding, though, was that more modern line filters may not, or if you use new disk capacitors made for the purpose (usually rated .01 mfd, 500 volts and up -- maybe 2000? I've seen some Corcom filters that have integral standard line cord sockets. I seem to recall a listmember posting that he replaces the original line filter with these and adjusted the back panel to allow the use of a standard equipment cord (as on your PC's, lots of test equipment, etc.) They also make the equivalent with solder terminals. I'm basically repeating back what I read here some time back, so somebody jump in who's been there/done that.

Date: Mon, 24 Apr 2006 15:33:32 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: RE: [R-390] R3 GFCI clarification

According to my reading of the code a dedicated circuit doesn't need to be GFCI protected, the inspector argues with me on that one though. I contend that a freezer should NOT be on a GFCI circuit because of the loss incurred by nuisance tripping. The same goes for sump pump circuits. Many inspectors are stumped by such things as explosion-proof wiring so they aren't neccessarily a good reference to the code,..... what are the requirements to be an electrical inspector?

> This was not the case just a few years ago (well, not that long ago GFCI's

didn't exist at all.)

Right, and I'm sure everyone's grounding systems are up to date, too. HAH! In some cases there is NO GROUND!

> > The most recent code revisions add arc-fault interrupters too...

Yup, I can't even find a supplier yet!

> > ....whenever I touch the chassis I get this big tingle".....

I just have to give them more credit than that, if they can't think that through then they should go watch American Idol. While we're on this subject. Have you guys with the big 120 volt transmitters checked your neutral connections throughout the house? Those put a big load on the neutral which could fail if the connections are loose. Joe

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Date: Mon, 24 Apr 2006 21:59:27 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Line input filter safety diatribe

Gentlemen, Gentlemen, Gentlemen,
WARNING: Ultra-long SAFETY Diatribe.

When I wrote before requesting people turn down their pacemakers to await the next nicker-twister I didn't realize it would be me who got them wound up again! Therefore, I gladly shoulder my responsibility to offer this carefully and scientific reasoned diatribe for the edification of all to follow my advice before SOMEONE GETS KILLED.

Wrote: we MAY HAVE NO CHOICE but to run a separate circuit for OUR R-3XXs! and: So wholesale changing the filtering is NOT the proper method of "FIXING". IF the filter is up to spec, leave it in place to do ITS JOB.

Three Strikes!
Strike one: Running a separate circuit requires a permit and still has to meet local specs. If it is in a defined "wet location" you will void your homeowners insurance if it isn't GFCI protected and something goes wrong.

Strike Two: The modern filters beat any of the original specs by a country mile. A standard unit can have 250 micro-amps leakage and 50 to 75 db attenuation from 1-30 MHz..

Strike Three: It is beyond reason to use a part that can kill you when the

better replacement part won't.

Wrote: question... Why are people plugging their boatanchors into GFCI circuits and the only circuits in my house with GFCI breakers are in the bathroom and outside outlets.

Answer: 1) That may be the only choice they have. 2) If there are no GFCI's in your kitchen it doesn't meet current (pun intended) code requirements.

Wrote: This radio and this entire subject isn't for the beginner nor is this manual to be considered a basic primer to the subject.

This is true in the theoretical. In the practical world we all get stuff we aren't experts in. It's part of the BA addiction. See the question below from a licensed Ham. The filter is a known "gotcha" as is the Mechanical Filter blocking capacitor. The difference is that this "gotcha" can kill you and there is a perfectly safe better alternative. I know lots about electrical safety as I fixed medical equipment for 25 years. It was part of my everyday work. Everybody starts from ground zero. I could only use a "Smith Chart Calculator" for a frizzbe, others can design solid state UHF amplifiers with it. We all learn faster and safer when we get "Elmer" advice.

Wrote: I had to assume that the house wiring was correct and up to date.

A fair assumption considering the scope of your advice was covering the only the radio and you did this well. Considering the feedback we are getting on the list about wiring problems members are encountering we may need to add some comments in R3 cautioning people about verifying their electrical systems

Wrote: (off line to me) I have a 390A with the leakage problem. Could you please give me an idea of what computer type circuit you are referring to, or how I could get one ? WXXX.

Glad you asked. But first an explanation of why. Modern electronic equipment is designed to have a two fault failure system before posing a hazard. This means for example , if you lose your green ground chassis connection the ungrounded equipment does not have enough leakage current to cause harm even if the polarity is reversed. Due to the design criteria this wasn't stated and from a logical use planned for the equipment wasn't necessary With the stock R390A filter, you have without GFCI circuits, a one fault system. If you lose your ground, it can kill you. With GFCI wiring it will trip the GFCI breaker tempting "fudging"or "moonlight engineering" work arounds that usually range from ill-advised to "death looking for a place to occur." There is nothing special in filtering terms

about the stock R390 filter. In fact, it is less effective that what you can easily acquire today. There are two types of filters generally available. The ones called "Medical Grade" but they are way over-kill. A standard unit can have 250 micro-amps leakage and 50 to 75 db attenuation from 1-30 MHz.

The easy way.
Obtain a defective computer power supply. PC shops will usually give you one or charge a couple of bucks. Remove the IEC power input connector. It should be about 3 inches long if it is a filtered plug. (A 99.99% certainty.) It may also have an additional EMI filter soldered to the leads. This is a good bonus. Remove the power input connector. File the chassis a bit and mount it in the hole. Disconnect the old filter AND THROW IT AWAY. Wire in new filter. Enjoy your safe radio.

A bit more difficult.
Use any major parts suppliers catalog, paper or on-line. Go to the line input filter section. "Corcom/Tyco" is a major brand. Look at the rated leakage specs for the filters. Either use one with an IEC power connector or you can buy them with solder lugs. There are a bizillon types. All you need is a 3 amp unit. Pick the performance you want. Buy. Install. THROW AWAY THE ORIGINAL FILTER. Enjoy your safe radio. I blatantly DO NOT apologize for using this much bandwidth. Keeping people on the radar screen is far too important. Live Long! Stay Healthy! Regards, Perrier
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Date: Tue, 25 Apr 2006 05:35:36 -0400
From: Rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Line input filter safety diatribe

The FULL text:

A) Use your brain! IF your CODE does NOT allow for the first option - DON'T DO IT!

Option #1: The real REALITY in our shacks is that we MAY HAVE NO CHOICE but to run a separate circuit for OUR R-3XXs! We ALL know that the filters installed leak JUST enough to trip a GFCI protected circuit. So wholesale changing the filtering is NOT the proper method of "FIXING". IF the filter is up to spec, leave it in place to do ITS JOB. Take a HEALTHY look at shack circuits. Put one in place that is NOT GFCI protected OR use an isolation transformer methodology!

B) Second option! Isolation transformer system! AND for Lord's sake, INSTALL A VERY GOOD and HEALTHY ground system with EVERYTHING grounded! I have four, (4), copperweld rods outside the shack, all connected with 1/4" bare hard copper clamped AND soldered to the rods.

This has been brought into the shack in ONE CONTINUOUS RUN that is attached to a 2" x 12" x 1/4" copper bar. All equipment in the shack it tied to the bar with a MINIMUM of #10 AWG. DO IT RIGHT! If you don't. YOU may be the next SK!

C) Third Option! Use a "computer filter" system. OUTBOARD IT! Use a project box, AND BOND IT TO GROUND! I have a VERY high level of distatse for "taking out of context" and only using "excerpts"!

Date: 25 Apr 2006 13:24:16 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: Re: [R-390] Line input filter safety diatribe

Another option. Gut the original filter and connect the wires directly to where the filter connections used to be. This will allow you to maintain the original look-n-feel of the radio from the back side without modifying the back panel. Feed the radio with a filtered line of your choice. I did this by building a box onto the back panel of the cabinet that contains a modern filter that feeds a standard power recepticle. My radio plugs into this receptacle. Conceivably, you could mount this in a small aluminum box that could be attached to the back of the radio using some existing holes. Someone correct me if I'm wrong, but the radio can be run without any line filter, right? Sure, you'll get more noise, but you also won't run the risk of having a hot chassis. As long as you aren't running the radio with very dirty power, it shouldn't hurt, right? Again, someone correct me on this.
Barry - N4BUQ

Date: Tue, 25 Apr 2006 9:04:57 PDT
From: Gary Gitzen <r390a@uwave.com>
Subject: [R-390] A different GFCI option

I'm surprised no one has suggested a different approach to using a GFCI with an R-390X, one which both works safely and is code legal.

First, let's rehash the basic "problem" with using a GFCI in a "normal" 120 VAC circuit: the AC inpput filter has caps going from each side of the line (hot and neutral) to chasis. Under "normal" conditions, with a properly grounded chasis and a neutral at 0v, we have unequal current flow between the two supply lines. The "hot" leg will show a load of a few (approx 5?) mA to chasis, and the neutral will show a load of zero mA to chasis. This approx 5mA differential current flow will trip a properly functioning GFCI. That's why they exist. Some folks, for whatever reason (typically National or local electrical codes) must use a GFCI and experience problems trying to power an R-390X. End of rehash.

One possible "solution" to this issue is to not ground the chassis of the R-

390X. This will "work", but leaves the chassis (and antenna lead in?) floating at roughly 60 VAC. Not a good idea, especially if one of the "hot" caps in the line filter should ever short.

Another suggested solution is the use of an isolation transformer. This will "work", but partly defeats the use of the GFCI, especially during fault conditions.

A third, as yet unmentioned, solution exists; one gaining popularity with the professional audio crowd. [Please note "Professional Audio" vs "Audiophools".] This third option is to differentially feed the 120VAC line as two out of phase 60VAC legs, just like a 240VAC line is two out of phase (differentially fed) 120VAC lines. Each 60VAC leg is derived from a center tapped isolation transformer, with the center tap connected to green wire ground. Each 60VAC leg goes through a breaker panel with double breakers tied together, just like for your electric dryer or other 240VAC circuits, so that any dead short will pop both breakers and avoid the "widowmaker" situation of a supposedly dead supply line being hot.

Now for the good parts:
Each 60VAC leg can be connected to one side of a normal 120VAC GFCI. A R-390X can be plugged into this GFCI. All leakage through the filter to a grounded chasis is now virtually _balanced_, and thus will not trip the GFCI. The best news: it's code legal. The bad news: it's not easy to set up, and the appropriate center tapped 120VAC transformer may be hard to find. One option is a surplus 120/240VAC isolation transformer, with each side having two 120VAC windings. If these windings are seriesed for 240VAC, but one side is fed with 120VAC, the other side is now a center tapped 120VAC source. Such transformers are sometimes found in old mainframe computers. Mine has a rating of 5KW, roughly 20A at 240VAC, but it will also carry 20A at 120VAC in the above configuration. I've seen smaller such transformers available.
Agreed, load regulations suffers slightly, but that's a small price to pay; and the R-390X _was_ designed to operate from a wide voltage range.
Suggestion: if you do this, have a DPST toggle switch (or relay) in the shack to open _both_ of the 60VAC legs when you turn off power.
This same concept can be applied to a much smaller scale "plug in" version which does not need electrical permits. Obtain a similar 500W-1KW 120/240V isolation transformer, an appropriate double breaker, another GFCI, and a metal box. Build everything in the metal box, plug it into your AC outlet (which may be already GFCI protected) and you have the best of all worlds: an affordable, portable GFCI trip-proof adaptor which will still trip if any leakage fault occurs in your R-390X or other equipment connected to it. Hope this helps solve a nagging problem. Gary

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Date: Tue, 25 Apr 2006 12:23:18 -0400

From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] A different GFCI option

I would like to point out that many shipboard electrical installations result in exactly what Gary's scheme yields. Shipboard I believe that the center tap is usually made at the generator and not at the load. The shipboard scheme (max 60VAC to ground) always seemed safer to me although I am completely unqualified in making safety judgements.

Date: Tue, 25 Apr 2006 20:50:13 +0200
From: "Paul Galpin" <galpinp@absamail.co.za>
Subject: [R-390] GFCI trips!

1. US GFCIs (Earth Leakage Trips to us in RSA) are set to go off at about 5 mA. This means that they are only used in (apparently) dangerous places, like bathrooms - or so I was told by US R39x owners.

2. The R39x filters have capacitors from Line to Earth, and Neutral to earth, so they pass a "leakage" current and trip the GFCI. This is not a component fault, but a 50's design anomaly which we have to take into account.

3. In RSA, our ELTs trip at around 30 mA, and must, by law, be active in circuit with every power socket in the house. In Gauteng, it is normal to have the entire house on the ELT, but down here in Eastern Cape it's usually only the wall sockets, not lights, geyser, or stove. I know, from experience with an R390A, that the filter will pass _almost_ enough current to trip the
breaker, which means that just a couple of mA on any other circuit will do the job! Very frustrating to find!

4. One cure for this is to open the filter, and lift the capacitors off ground,, so that they are only across the mains power supply, OR as 5 below.

5. Using an isolation transformer to supply power, one has the choice (if local regulations allow) of earthing one side of the secondary, or balancing it about earth to give max 110V (or 55V in 110 countries) to earth. If you then put a separate ELT (GFCI) on the isolated balanced circuit, you have the best of all worlds!

5. AFAIK, modern equipment with built-in mains filters does not connect to Earth. It relies on series chokes, and parallel capacitors across the power supply. Presumably, this is because of the problems caused to ELTs (GFCIs).

Date: Thu, 27 Apr 2006 17:01:50 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>

Subject: [R-390] RE: GFCI trips!

In equipment filters and prepackaged IEC cord connector/filter modules I have seen here in the US, capacitors from each side of the line to ground (earth) are used. These capacitors are typically .0047 uF and so pass only a small leakage current. The usual configuration has a capacitor of about 0.1 uF from hot to neutral followed by an inductor in both lines. At the output is the pair of .0047's from hot to ground and from neutral to ground. Some of the better
filters precede the aforementioned arrangement with another capacitor across the line followed by another pair of inductors.

I have seen the schematic for some of the medical type filters; they appear to be like the others but without the caps from line and neutral to ground.

In all of the more modern designs that I have seen the inductors are both wound on one core. I opened up a line filter from a '61 Teledyne-Amelco (filter bearing a date code of the same year). Relatively easy, but dirty and smelly torch work. The arrangement was essentially 2 seperate filters, one in each line. The incoming line (hot or neutral as applicable) was connected to a small toroidal inductor. The output of that inductor went to a .082 uF cap to ground and to the input of a larger toroid. The output of the larger toroid went to another .082 uF to ground and to the filter's output terminal.That makes a total of 4 caps and 4 inductors, in two separate L-Pi networks.

The original filter might be restuffed/reconfigured as in the "better filter" configuration mentioned above. From line to neutral would be, say, 0.1uF, both lines then go to both small toroids. The outputs of the small toroids would be bridged with another .1uF, then feed the inputs of both large toroids. The outputs of the large toroids would each have .0047 uF to ground and would feed the filter unit's output terminals. I have no idea of how well that configuration would work using the original seperate inductors instead of the more modern ones with 2 wound on each core. The mutual inductance/magnetic coupling between lines in today's filters must have an effect. Line filtering capacitors MUST be types specifically rated for that service. Mouser, Digi-Key and many other suppliers carry them. Do not use capacitors which are not rated for line filtering service no matter how high their voltage rating might be. The caps which are connected from line to ground or chassis and whose failure in a shorted mode would present a shock hazard are designated Class Y. Class Y caps are designed so that the predominant failure mode is open (fail safe). For across the line use where failure would not present a shock hazard, Class X caps are used.

Both X and Y type capacitors are designed to reduce the risk of explosion and fire when subjected to large transient voltages. I have seen in

equipment of 20-25 years ago another line filtering configuration. That older arrangement has at at the filter's output a cap of 0.1uF or so across the lines and a larger cap (1 uF) line to ground. That arrangement seems to be no longer used. A fault condition in supply wiring with hot and neutral swapped AND with ground not connected would make the chassis mighty hot. I can only guess that is the reason for that arrangement's demise, and for the introduction of today's two small caps to ground.

Finally, one could just install one of the prepackaged connector/filter modules as seems to be popular nowadays) and dispense with all the filter re-engineering.

Date: Fri, 6 Oct 2006 08:20:27 -0400
From: "Dave Maples" <dsmaples@comcast.net>
Subject: RE: [R-390] New Owner

All: Considering that the GFI is probably protecting more than the outlet where the R-390A is plugged in (e.g. the laundry room or kitchen) I would NOT remove the GFI. I don't think I'd like doing that and then finding my wife or other loved one electrocuted. (rant on) Folks, we simply have to use our heads on this stuff. There are reasons why the National Electrical Code contains what it contains. Most of us have spouses and children who we love more (I hope) than the old radios.We have to take care of them as well as ourselves. (rant off)

If it's really, really important that you don't modify the equipment, run a new circuit with no GFI from the breaker box to your bench. Plug your receiver into that. I purchased an off-the-shelf Corcom line filter with IEC plug built in andput it in the place of the old filter. I use a 3-wire instrument cord to feed the R-390A. It's not original, but I don't care. It's safe and operable.

Date: Fri, 6 Oct 2006 08:30:29 -0500
From: Tom Norris <r390a@bellsouth.net>
Subject: Re: [R-390] New Owner

No asbestos underwear needed, that's the best and most sane solution. Since we aren't running these things off generators and other "unclean" power sources or around high power transmitters (for the most part), there isn't such a need for the brute force filtering they were originally spec'd for. (IMHO)

Date: Fri, 06 Oct 2006 10:17:26 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] New Owner

And if you still want really good line filtering, you can sink some bigger bucks (more than $30 last time I checked) into a two-stage IEC line filter. It won't trip a GFCI, and it will be superior to the original single-stage filter. Probably overkill. You will note that if you look into the catalogs most of these modern filters are intended not to stop noise from coming into the device, but to stop noise from coming out! I think there's somebody's theorem that says that if it stops it coming in it will stop it coming out. (reciprocity theorem?)

Date: Fri, 06 Oct 2006 10:51:30 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: [R-390] GFI devices (was "New Owner")

Some further comments on GFI (Ground Fault Interrupter) devices: Dave is thinking of the case where the circuit breaker panel has a GFI circuit breaker that feeds a number of outlets on one circuit. A more common situation is where the OUTLET itself is the GFI device. (It could be that modern electrical installations have the GFI circuit breakers, I don't know. I have always lived in houses much older than modern.)

A duplex GFI outlet has two teensy buttons located between the two outlets: one is often red but not always. If you push the one marked "test", it causes a ground fault condition and the thing should trip. The other button pops out. Push the other one back in to reset the device. It's smart to do this from time to time to make sure the thing is still working. The GFI circuit breakers likely have a similar function. It makes sense to me to never paint a GFI outlet. The paint might keep it from functioning correctly. (Of course if I was on the IEC committee that developed the standard(s), I would have thought of that. Maybe they did.)

A Duplex GFI outlet can be wired to feed other normal outlets and protect them. You should suspect this is the case if you have, say, at the kitchen counter, a number of outlets and only one of them is a GFI device. (NOTE: It can also be wired INcorrectly to feed other outlets and NOT protect them.)

It's a VERY good idea to have and use one of those little outlet testers you can buy at the home store. They cost about $9 and are the best money you can spend for household electrical safety. They have a row of neon lamps and can tell you if you have a mis-wired socket. There are a number of ways an outlet can be mis-wired or at fault. In some cases, the thing will work just fine even though there is trouble. Buy one of those testers, and test every outlet you can find. It doesn't take long, and can avoid big troubles. If you have an outlet which has one side on all the time and one side controlled by a wall switch, test both sides. Electricians and installers are supposed to know what they are doing, but they are human and make

mistakes.

If you have multiple outlets protected by a GFI outlet, plug the device, or a lamp, into the other outlet(s) and push the teensy button. It's easy to see if the thing is wired right. The outlet tester will not tell you if the GFI outlet is wired to not protect the other outlets without you pushing the teensy button. A GFI device works by comparing the currents in the Hot and Neutral wires. If the two currents are not the same, that means that some current is going elsewhere - through your body, for instance. I understand that most GFI devices are meant to trip with about 5 milliamperes of current imbalance. I also understand that in some situations, a properly operating GFI device will not protect you from some dangers, but I don't know much about that situation, yet. Be safe, Roy

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Date: Fri, 06 Oct 2006 11:02:17 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] New Owner

Has anyone got information handy to compare the filtering specs of the R-390A and the common line filters with IEC connector? If so, please report. Note: one of the cost reduction points of difference between the R-390/URR and the R-390A/URR is in the line filter:

- In the R-390/URR the filter has an integral connector of substantial construction
- In the R-390/URR the filter has more stages of filtering than in the R-390A

One result of this is that a simple adapter plate can be made for the R-390/URR to hold the modern IEC type line filter/connector with no holes or sawing, whereas in the R-390A/URR, a bit of metal work is needed unless the connector is mounted in a little box mounted on the back of the radio. Lest any of you decide to go looking for a Greenlee chassis punch to make the job easy and neat, I understand the new price of the right punch is over $200.00.

Date: Wed, 04 Jul 2007 22:44:11 -0400
From: Dave or Debbie Metz <dmetz@ntelos.net>
Subject: [R-390] Isolation transformer question

This thread has renewed a question I have had for a long time. If one uses an isolation transformer plugged into a GFI, what are the implications? It would seem like the GFI cannot "see" a leg difference. Does one lose the safety of a GFI in this case?

Date: Thu, 05 Jul 2007 08:09:10 +0000

From: Sheldon Daitch <sdaitch@mor.ibb.gov>
Subject: Re: [R-390] Possible source for isolation transformers?

Many wall-wart power supplies these days are all voltage, but you have to make sure from the PS specs. My US Nokia cell phone charger is identical to my European Nokia cell phone charger, except for the wall prongs, the US one fits US outlets, and the European one fits the larger round two prong European outlets. I also bought, some years back, a Radio Shack multiple output voltage wall-wart type PS. This works on both 110 to 240 and have a switch selectable DC output, plus it uses RS's line of add-on output plugs.

Date: Thu, 05 Jul 2007 08:31:42 -0700
From: "Kenneth G. Gordon" <kgordon2006@verizon.net>
Subject: Re: [R-390] Isolation transformer question

I use those power cords that are used for computers. I have a large box of them at work. EVERY darned computer peripheral made comes with one, and when the stuff craps out, I keep the power cords. You have to be SOMEwhat careful in selecting them, since the wire size (current carrying ability) varies. Also, most I have use the European color coding for the wires. I.e., not black, white, green, but blue, yellow, and green. I cut the female ends off and install them. Most are at least 6 feet long, and have a very nice molded-on male end on them.

Date: Thu, 05 Jul 2007 11:40:57 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Isolation transformer question

I use the same cord but do not cut the female ends off. Instead I put an IEC-320 jack on the back of the equipment so it just plugs straight in. I'm sure I'm ruining the purity of the original ungrounded cord but really it is an improvement for anything regarding usability. For anything likely to make or be sensitive to RF, there are IEC jacks with built in filters, fuseholders, etc.

Date: Thu, 5 Jul 2007 11:58:33 -0700 (PDT)
From: "W. Li" <wli98122@yahoo.com>
Subject: [R-390] re: R-390] Isolation transformer question

Interesting discussion re isloation transformers. I think one thing to not forget, is to bypass/remove the vintage R390 line filter and replace it with a modern IEC unit. This answers your query re line cords: use a spare *computer* grade cord. We all have many unused ones lying around the shack. Some of them are heavy duty with 16G (?) wire. All of them have the required third wire ground. There was a real good discussion re AC grounds a while back that bears re-reading.

Agree with you re the Variac/isolation transformer box. Mine is deluxe homebrew with surplus mil-grade AC amps and AC volt analog meters.

Date: Fri, 06 Jul 2007 10:09:56 -0700
From: "Dan Merz" <mdmerz@verizon.net>
Subject: [R-390] Gfi receptacle

Hi, has anyone encountered a GFI receptable that didn't want to let go of a two prong plug? I was using a small soldering iron in my garage to put a connector on coax going up to my antenna and I plugged into the the nearest outlet which was a GFI outlet. Everything worked OK but when I was finished and tried to unplug the soldering iron, the outlet didn't want to let me pull it out. This is the first time the outlet has been used (new house). I finally got it out by twisting/pulling but it toOK enough force that I thought maybe it was going to pull the tines right out of the plug. Does the third prong (ground) and the fact that I was not using it have something to do with this behavior? Or is this likely a faulty receptacle? The receptacle is a white household type with a reset button in the middle.Maybe it needs some lubricant? I just went out and tried a three prong plug and it worked OK. Then I tried the soldering iron again and it worked OK. It was almost like it had welded in before but now it's working OK
apparently. Now on closer inspection, I see a small area on the edge of one of the prongs where the brass is zinc colored and maybe it was welded there to the outlet....any similar experiences ? Probably had nothing to do with GFI. Dan.

Date: Fri, 6 Jul 2007 18:56:59 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Gfi receptacle

Nah, better receptacles have VERY stiff spring contacts when new.

Date: Sat, 07 Jul 2007 11:10:59 +0000
From: "Gene Dathe" <dathegene@hotmail.com>
Subject: [R-390] Isolation transformer question

I concur. Grabbing hot and neutral anywhere anytime is a bad idea! My original post may have been unclear. (Not the first time!) By installing an isolation transformer, on a line equipped with a GFI, you *lose* the protection of the GFI. You *gain* the protection of the i.t. Two different ways to provide protection about 50 years apart. Use one or the other. With the R390A, you can:

1. Use an isolation transformer and run as is.
2. Use a GFI and upgrade the line filters in the radio up to modern standards.

Either way will get you a radio with a shock-free chassis. Have fun, Gene
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Date: Thu, 9 Aug 2007 21:45:02 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] Voltage regulation and vintage equipment

Lessee, not long ago, last winter perhaps, the complaint was high line voltage, which can shorten tube life. Most of the electrical power in a house goes to the refrigeration compressor, unless you have electric heat or keep your stove on all day long. Motor loads tend to constant power at constant speed, so line current goes down as line voltage goes up. Power distribution is limited by the current-carrying capacity of the wires. The line voltage is raised in order to sell more power without changing out existing equipment. The power company loses money as the current goes up because of I**2 R losses. It makes no sense for a power company to lower the distributed voltage, specially during the air conditioning season.

It is far more likely that the growing population has overloaded the existing equipment. This is all a part of the general neglect of society's infrastructure, while raising profits by not repairing things. The 35W bridge in Minneapolis is the latest example of how our public servants serve themselves, while emptying the treasury by pandering to the "No taxes for me, thanks!" crowd.

I mean, there's "If it ain't broke, don't fix it" and then there's an inspection that says 50 of 150 things are not broke. Most things have a tipping point, after which the collapse feeds on itself. The 'Me Generation' that hates taxes then points fingers at everyone but
themselves. That's how they got to be that way, by not taking any responsibility for anything. And you and I vote for people that pander to them to get through the next election. Whoops, I fell off the soapbox ...

Date: Thu, 9 Aug 2007 22:34:40 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Voltage regulation and vintage equipment

I agree...I think the intentional brownouts are probably a way of explaining away the brownouts that are inevitable during high load periods of the day once the utility has reached it's limit of line voltage regulation. The worry is that something will eventually burn down...and if it's big enough when it goes it will usually cause enough instability to trip a generator off line and if that is not managed properly as has been seen in

the past, instability in the entire power grid can result with generators tripping off all up and down the east coast. Not a good thing for the industry. I am proud to say that there has been a tremendous amount of money put into the transmission and distribution systems in the companies I work for. I know of several transmission line projects where the line is built to 230KV specs but is run at 110KV. Over built to allow future growth potential.

Date: Thu, 09 Aug 2007 09:31:14 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: [R-390] Voltage regulation and vintage equipment

I got home, after a very very hot day yesterday (102, which is hot for here!), and turned on many of my old radios. Lots and lots of atmospheric noise although no thunderstorms broke in my neighborhood. Noticed that for some unknown reason, few to none of the neon bulbs on the equipment was lit. Stuck my voltmeter probes into the wall socket, was getting 98VAC. Found out this morning that the utilities had purposefully cut back on voltages delivered to limit power demand.

Of course many modern computers and other power supplies will in fact suck more current as their input voltage drops. The 390A's, no neons in them, the good old #328's lit up fine although in retrospect I shouldn't have been contributing to the brownout!

Date: Thu, 9 Aug 2007 09:09:37 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Voltage regulation and vintage equipment

I work for an electric utility and that's not something your utility would do...reducing voltage does not reduce load....it does however put the utility at risk of damage claims. Things with compressors and electric motors will not function properly and will overheat. It is more likely that increased load caused the low voltage condition...there is only so much the utility can do to keep the voltage up and with the increased heat there comes increased loss in transmission and distribution lines only adding to the problem. It's a house of cards in many ways and I am quite surprised there have not been any systems
tripped off line and blackouts so far...

Date: Thu, 09 Aug 2007 10:26:14 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Voltage regulation and vintage equipment

Well, I don't know why they do it, but if you look at the press releases, PJM US Mid-Atlantic in my area and ConEd in Brooklyn and Manhattan were

announcing the brownouts (by 5 to 10 percent) as part of their policy the past day or two. What I saw in my house was closer to 20 percent from the usual (although maybe 10 percent from the low band).

Simple loads (e.g. light bulbs) will reduce power use if you cut the supply voltage. (Even though light bulbs are not linear resistors, cutting voltage will always cut current). Part of my post was wondering if for example AC compressors and computer power supplies work as simply (I suspect many switching supplies will just suck more current as you cut their input voltage).

Date: Thu, 9 Aug 2007 13:56:30 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Voltage regulation and vintage equipment

Well I see from some reading on the net that this is in fact a practice used by some utilities... Sorry about that....I can truly say in the 40 or so years I have lived in the deep south we have never had such...except when something was damaged on the electrical system and it's duration was no more than a few seconds....I guess that's why I made my statements. It appears that these intentional brownouts are on systems that are running at or near capacity most of the time anyway and these steps are taken to try to force some of the load down.

My comments about it being a bad thing for stuff you own that runs on electricity was verified buy my search of the net. Inductive loads don't like brownouts and will most likely generate more heat and can be damaged. Resistive loads don't care much but who has much that is pure resistive anymore. Electric water heaters, stoves and lighting. It seems to be universally recommended that once the brownout begins you turn off all non essential stuff like washing machines, electrical cooking and OH don't let me forget...Air Conditioning....right! That's the load that is causing the problems to start with... And what if you are not at home to do this...well something might just burn up... I knew there were problems associated with low line voltage I just didn't expect utilities to do it intentionally... I learn something new everyday!

Date: Fri, 10 Aug 2007 16:06:35 -0400
From: "Steve & Carol" <srosenb2@nycap.rr.com>
Subject: Re: [R-390] Voltage regulation and vintage equipment

I worked in Electric System Operations for 30 years (8 yrs for Keyspan Long Island and 22 for the New York Independent System Operator) and as Cecil has dicovered on the net electric utilities can and will reduce voltage at the distribution level. It can be done by 3, 5 or 8% but 5% is the most common reduction used. Many companies across the nation have this

available to use if needed to mitigate load. The effectiveness of reducing voltage has been reduced over the years because of regulated loads like computers, UPS systems, some lighting systems etc. It is not used very often on large scale. It can be applied to just one substation or as many as needed. I looked at it as short term aid that tends to dissipate due to things like AC compresssors cycling on and running longer than normal.

As far as having 98 volts at someone's house, if that were me I would shut down my AC and other high load devices to protect them and mitigate the problem. Voltage that low can occur for many reasons. The obvious being the system being stressed to the max but normally there would be enough resources to do better than 98 volts. The substation tap changer could be stuck or locked out, this happens when two transformers are in parallel and get out of step, the transmission voltage coming into the sub may be to low due to a reactive shortage on the system. Distribution caps on your circuit may have tripped, shorted out or failed to come on line. These caps are very important to maintaining normal voltage on the whole circuit as the loads increase. Some of them are on all the time, some are controlled remotely via radio, some by voltage sensing relays and also by time clocks. Also the circuit may have been reconfigured due to problem somewhere and you might have ended up on different circuit that now has to much load on it. Distribution circuits have many switches and tie points that can opened or closed for repair work or to clear faulted sections.

Date: Fri, 10 Aug 2007 14:42:18 -0600
From: Transmaster <22hornet@gmail.com>
Subject: Re: [R-390] Voltage regulation and vintage equipment

What you could do is install a residential line conditioner, and voltage regulator. As you know they regulate the voltage within your house and the conditioner cleans up the electrical signal and reduces line noise substantially. <snip>

Date: Mon, 20 Aug 2007 01:02:28 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] Need help fixing R390A not to trip GFI breaker

Been through this many, many times before. There were no GFCI outlets in the fifties, when these sets were designed. The RFI filters use 0.1mfd caps, with a 60Hz reactance low enough to trip a modern GFCI. R390 class receivers require an Earth ground. Ground them, and do not use a GFCI outlet. If you can't avoid the GFCI, then use an isolation transformer, but be sure to ground the set. You can remove the RFI filter, but consider the number of RFI sources today that weren't there in the fifties. I say "you can do it" but no licensed electrician can break away from the code set by people who will not let themselves be associated with any kind of failure.

Can you say "CYA?" Return your shop to the fifties, with a rubber mat on the floor, and all will be well.

Date: Tue, 21 Aug 2007 13:56:23 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Need help fixing R390A not to trip GFI breaker

You can probably pick up one of those testers in Home Depot, or a hardware store of some kind. But they're basically a convenience. They basically just consist of 3 neon bulbs (and resistors) in a molded grounded plug. You can check with a multimeter on the right AC volts range. You should get line voltage (110-125 VAC) from the smaller slot (hot) to the ground lug. (If no voltage reading, the ground is not wired or has excessive resistance to ground.) You should get _no_ reading from the neutral (larger slot) to the ground lug terminal. If you get a reading between the ground lug terminal and the neutral, the outlet is wired backwards and should be corrected.

Those things are handy when reaching under a desk/table/bench, etc, but you can also use the meter with an extension cord or outlet strip to accomplish nearly the same convenience. Or if you have a bunch of NE-2 bulbs, make up your own. I don't recall the resistance value that's used with them. However, as I recall, those neon bulbs don't light until there's at least 60 (or was it 90?) volts. A meter would give you somewhat more info in the event of a leaky situation or excess resistance on the ground. There's some kind of disclaimer with those handy testers -- they don't cover all types of faults -- just a 3-bulb deal.

Date: Mon, 22 Oct 2007 18:22:56 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] R-390A problems - rethink soil conductivity

A ground rod is a device for lightning protection rather than an RF ground. Even in "good" conditions they make at best a poor RF ground. The only way to get a good RF ground is to either live in a salt marsh, or bury some radials. A few hundred chunks of copper wire generally will do the trick ....

Date: Mon, 2 Feb 2009 16:45:36 -0800 (PST)
From: Steve Toth <stoth47@yahoo.com>
Subject: [R-390] GFI breaker trips

Plugged in the Motorola so it could "cook" for a while and the GFI breaker tripped in the garage. Wei-i had mentioned this and included a computer cord type AC receptacle for the back of the R390A to replace the NOS AC filter.

What is involved in installing the best mod to prevent the GFI breaker from tripping?? Or where do I look to get the info?

Date: Mon, 2 Feb 2009 19:14:37 -0600
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] GFI breaker trips

Lacking a modern filter, your best bet is an isolation transformer.

Date: Mon, 2 Feb 2009 19:17:13 -0800 (PST)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] GFI and the 390's

The GFI trips because the original AC input module had large .05mF caps from hot and neutal to ground. This was done to prevent any RF from getting out; a security issue during the Cold War. Such a large cap will pass enough 60cps current to trip any GFI. The reason I gave you a modern EIC type AC input module, is that the modern ones have a much smaller line bypass caps (2200pF) so that AC current passed is much lower, not enough to trip a GFI. In my Capehart, I removed the original AC input module, filed the back panel just enough to clear a brand new EIC module, and rewired the AC circuit. Of course, the unit's chassis should be securely grounded separately. There is a lively extensive dicussion re GFI's and grounding in *Pearls* in the pwr supply chapter (shameless plug).

Date: Tue, 03 Feb 2009 04:17:10 +0000
From: "Bill Kirkland" <kirklandb@sympatico.ca>
Subject: Re: [R-390] GFI breaker trips

here is my guess: If the filter is configured for common mode and uses what is called a Y capacitor configuration, then there is a capacitor connected from the Hot AC wire to ground and from the Neutral AC wire to ground. There will be a small current flowing from the Hot AC wire through the decoupling cap to ground and this may be what is tripping your Ground Fault Interrupter. An X capacitor configuration has 1 decoupling cap that is connected between the Hot and Neutral wire. Trisha: how did I do ?

Date: Sun, 26 Jul 2009 16:13:18 -0400 (EDT)
From: "Richard W. Solomon" <w1ksz@earthlink.net>
Subject: Re: [R-390] line filter for EAC R390A

Are you saying that grounding through the third wire of the line cord is not sufficient ? Maybe that's why the thing kept popping the GFI.

Date: Sun, 26 Jul 2009 16:29:08 -0400

From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] line filter for EAC R390A

GFIs "see" current in the ground as a "fault" above the limit that a GFCI "can" allow. So the saying that the grounding through the "third" or "green"/"bare" IS what is popping the GFI. An R-390a with the old filters will stay on when it happens to NOT be on a circuit protected by GFI devices.

Date: Sun, 26 Jul 2009 17:47:57 -0400 (EDT)
From: "Richard W. Solomon" <w1ksz@earthlink.net>
Subject: Re: [R-390] line filter for EAC R390A

What has all that got to do with using the third wire as a ground ?? I removed the filter since I was not concerned with the neighbors checking up on what I was listening to.

Date: Sun, 26 Jul 2009 17:58:46 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] line filter for EAC R390A

Precisely what I wrote! The third wire is doing what it is supposed to do! It conducts the leakage back to the panel. With leaky filters, this is seen by the GFI as FAULT! Therefore, it trips. What has the neighbor got to do with an old system that has leaky filters?

Date: Mon, 27 Jul 2009 00:01:34 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] thanks

The 60 volts will appear on an ungrounded chassis if the line filter is working correctly. It's not clear to me how the line filter can cause a mechanical audible hum (that is, not heard in the audio output, but rather coming from the radio itself.) Can someone explain this to me? (I certainly can explain the 60 volts.) Roy

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Date: Mon, 27 Jul 2009 08:42:49 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] thanks

Not from 390A experience, but from other ham and consumer radio experience: Line filter caps have this tendency to begin failing on line voltage peaks. So what you get is a 60Hz or 120Hz noise coming from the capacitor as the layers begin to arc over. If it's not in a metal can, it is very very common to see wax or fumes coming from a wax capacitor at this point, and sometimes you can see little sparks inside if the arc-over is

happening near the surface. It is also actually audible, either hearing a 60Hz/120Hz buzz or a curdling noise as wax melts or vaporizes. In a metal box there's much less to see but I can believe that a 60 Hz or 120Hz buzz could be heard. Sometimes line filter caps go from "OK" to "completely charred and a pile of hot wax" in a matter of minutes. In other cases it is a very gradual failure taking years, maybe only making noise on high humidity days etc. In old consumer radios it is very very common to see bulging or deformed wax capacitors with a pile of molten wax under it, or a black-charred chassis on top of it, and the radio still (at least mostly) works.

Date: Mon, 27 Jul 2009 13:02:29 -0700
From: Richard Loken <richardlo@admin.athabascau.ca>
Subject: Re: [R-390] thanks

Yes the there is 60V on the chassis and if you plugged it into a GFI outlet then the GFI would trip. However, the filter and the GFI are both working as designed and the R390 manual tells you not to operate the receiver without a proper ground (the implied reason being that the avarage operator gets tired of being whacked by 60V every time he touchs the radio).

Not that it applies to the R390 but 60V at what load? Take any device with a line filter (made by Corcom or Thomas Edison himself, it makes no difference) remove the 3rd prong ground from the chassis and measure from the chassis to ground and you will read X volts AC. Connect a resistor between the chassis and ground and measure the leakage voltage again and the reading should be lower. Again, ignoring the R390 and its outrageous capacitive leakage current to the chassis, but looking at more sensible appliances with their expecation of being handled and mishandled by the general population... Hmmm. Lessee, If I put a 1,000 ohm resistor on there and I still read (number picked out of the air) 10 volts then I would be leaking 10mA to ground - now I am going to get interested and so should any functional GFI since, AFAIR, a GFI should trip at 5mA. Have I got that wrong?

Date: Mon, 27 Jul 2009 20:43:10 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] line filter for EAC R390A

I would not replace the line filter with another of the same vintage. There are capacitors soldered into that bathtub that are prone to leakage after 40+ years of service.

What I have done is to replace the line filter with a hospital grade Corcom filter like a 3EHQ series http://www.corcom.com/Series/Medical/HQ/

This has a very similar footprint to the original filter but has much better isolation characteristics than the original. While you are at it, add a few 130 volt MOV's from line-ground, neutral-ground, line-neutral and an inrush limiter like a CL-190.

>From time to time you can find the 3EHQ or 6EHQ line filters on Ebay for $10-20 each.

When the R-390A was designed the greatest sources of interference would be from other radio equipment or radars, the occasional fluorescent light fixture or generator noise. Today it's computers, computers, computers, BPL, wireless Ethernet, X10 home appliance controllers and el-cheapo fluorescent bulbs. For several years I worked as a compliance engineer doing design and testing of products to meet FCC type acceptance. Eliminating radiated emissions, longitudinal and metallic noise and RFI shielding was a big challenge. Selecting a good line filter was a good place to start from.

Date: Mon, 27 Jul 2009 21:21:43 -0500
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] line filter for EAC R390A

While we're on the subject of line filters, can anyone suggest where I might find some 0.1uF, 600V, Y-Class caps? I thought I found them at one time on the Mouse site, but can't seem to find them again. They're for the line filter caps in an HP-606A.

Date: Mon, 27 Jul 2009 22:44:33 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] line filter for EAC R390A

Try justradios.com (in Canada). They have both X and Y type capacitors, some application advice for them, good prices, and fast shipping. I AM a happy customer of theirs.

Y2 Safety Caps @ 250VAC (film) 0.1uF 250VAC.....$2.69

X2 Safety Caps @ 275VAC (film) 0.1uF 275VAC.....$0.79

I suggest you carefully evaluate whether you need 0.1 uF as original.

NOTE: My suggested arrangement is to put one X cap across the line, line to neutral, and one Y cap from neutral to chassis. Failure of these types of capacitors is extremely rare, but if it should happen, with this arrangement, and assuming a fuse is in the hot line, there is no danger.

Date: Mon, 27 Jul 2009 22:27:37 -0500
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] line filter for EAC R390A

Mouser stocks these:

http://www.evoxrifa.com/cap_catalog/emisuppr/pme271y.pdf

However, they're only stocked in the 250V version. I'm curious if the equipment were to be run on 220VAC, if this would be sufficient rating.

Date: Mon, 27 Jul 2009 23:51:26 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] line filter for EAC R390A

Line filter/bypass caps are SERIOUSLY under rated. They are safety items and cost a bit more because of it. You can be assured that the cap rated at 250 VAC will run just fine forever at 220 Volts line voltage. I remember a tale told by an audio amp builder. He had some motor start capacitors rated at 440 volts AC and talked to an engineer at the manufacturer about whether he could run them at 550 or 600 volts DC safely. The engineer laughed, and said that they are all tested at some four times that and he can expect the caps to not fail, period. Do check the facts on this, but I think the line safety caps are of the "self healing" metal film type in that if they do short in a local area, the conducting part of the film burns away and leaves an open circuit. The justradios.com web site has further information about this, I seem to remember. They also offer dual-rated disk ceramic caps - the self healing aspects may not apply to them.

Date: Mon, 27 Jul 2009 23:03:48 -0500
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] line filter for EAC R390A

> Line filter/bypass caps are SERIOUSLY under rated. .....

I thought that might be the case. It seems they test these things at 6 or 8 times their rated voltage, but I didn't know if it was recommended to run them so close to their rating all the time. Apparently you can.

Date: Tue, 28 Jul 2009 09:11:39 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] thanks

I don't think we're talking about the same thing. A perfectly good, 100% new, line filter will put 60VAC on the chassis if you lift the ground. You

don't need any failure of any component or subcomponent at all.

Date: Tue, 28 Jul 2009 11:01:03 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] line filter for EAC R390A

I ran one of my R390As without a filter for a long time (until I replaced it with a modern line filter). It might have responded to light switches a bit more than one with a good (read: modern) filter, but other than that, I doubt it made any difference.

Date: Tue, 28 Jul 2009 08:49:01 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] line filter for EAC R390A

I have done exactly that: run a 390A with and without a line filter... no change in performance. In my case hum was due to bad pwr supply electrolytics, probably the most common source of hum ONCE the unit is warmed up. Hum in a cold unit is mechanical and most likely the EAC pwr transformer as others have pointed out.

Date: Tue, 28 Jul 2009 16:50:57 +0100
From: Graham Baxter <graham@delphe.co.uk>
Subject: Re: [R-390] line filter for EAC R390A

I isolated my line filter from the chassis using power transistor insulated mounting bushes. I fitted a solder tag under one of the bushes and connected a modern 4N7 class Y capacitor from it to the chassis. This mod can be reversed in minutes, it cures the GFI (RCD in English) problems, and does not much change the original appearance.

Date: Tue, 28 Jul 2009 12:44:59 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] line filter for EAC R390A

> I isolated my line filter from the chassis.....<snip>

HOWEVER, it does introduce the possibility of a dangerous situation. Should one of the bypass caps in the original filter fail shorted, full line voltage would be on the filter case. A future hapless owner might not know this and get electrocuted. This situation is very similar to the "cure" offered in Hollow State News years ago for a leaking B+ filter choke in the SP-600. They suggested to insulate the choke case (metal) from the chassis. This is very dangerous, especially there where the leakage fault is known, is present, and the voltage is more or less full B+.

Date: Tue, 28 Jul 2009 09:56:02 -0700 (GMT-07:00)
From: "Richard W. Solomon" <w1ksz@earthlink.net>
Subject: Re: [R-390] line filter for EAC R390A

Correct me if I am wrong, but wasn't the function of the Line Filter to keep noise from entering the receiver AND not allowing anything to re-radiate out of the receiver ? In both cases, if operated from the AC Power Lines and in a "friendly" country, doesn't that make the filter unnecessary ? Why not just remove it and solve all your problems ?? The Purists in the group can ignore this form of heresy !!

Date: Tue, 28 Jul 2009 18:14:44 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] thanks

I do think your filter was leaking beyond design. Happy to have you with us, Hope you are enjoying your receiver. What ere you doing to get Uncle to introduce to the worlds second best receiver? Did you get to use any R390's along the way?

Date: Tue, 28 Jul 2009 18:26:39 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] thanks

As current goes up from cap leakage, the current in the inductors increase. The leakage could be close to blowing a 15 or 20 amp breaker. But that current puts up a magnetic field in the parts of the filter. That magnetic field starts to "rattle" the parts inside the can. This all sounds like hum from the outside. Who knows how much current was leaking and how bad that filler is charred inside.

Date: Tue, 28 Jul 2009 18:27:23 -0400
From: Jim <jbrannig@optonline.net>
Subject: Re: [R-390] thanks

R390A leakage: a long time ago I had a PK-232 and a dot matrix printer set up for AP wirephoto reception. The audio feed was from the R-390A. At some point the circuit board in the printer "went west". I was quite some time before I figured out that it was the 60VAC from the R-390A ground that caused the damage. Since then I make sure there is a ground on the '390 and there has never been another problem.

Date: Tue, 28 Jul 2009 18:40:07 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] line filter for EAC R390A

A lot of the filter was 1940 military thinking. These receivers were run off generators and third world power sources. The filters were to help to cut out some of the whine and pop of theses sources. The filters also help on days with local thunder showers. The noise does not mess with the line voltage much but the lighting strikes do put some pops on the power source lines.

Date: Tue, 12 Jan 2010 12:41:05 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Power Cable Hack

Yea, I kinda like the idea of the GFCI breaker being able to trip. As opposed to a fuse, a GFCI device is to save my butt from electrocution if I cross into the mains side of a service. I had a good friend who died because of a bad cord on a saw. We were 17 at the time and it left a real impression upon me. I have gone so far as to replace a large number of breakers in the distribution panel with GFCI capable breakers. The bathroom and kitchen are not the only places you can get killed. It is a real inconvenience to install an old radio like a Central Electronics 20A and have it trip out the breaker. That forces me to get out the isolation transformer and play the "find the leaky caps" game. I never use an isolation transformer in-lieu of fixing the problem. Putting the line-filter on an insulating sheet to remove it's case from chassis ground is not a good idea. For all intents and purposes you have just eliminated any benefit to having the line filter in there at all. I worked as an EMI/EMC engineer for several years and putting the effort into modifying product designs to meet FCC specs was very gratifying. EM has a nasty tendency to take advantage of some of the most innocuous practices like how many times you put your mic cable next to the line cord or how clean and tight a connector is.

Date: Thu, 18 Feb 2010 17:25:00 -0600
From: "Dr. Gerald N. Johnson" <geraldj@weather.net>
Subject: Re: [Collins] [TenTec] Electric safety

While the mark left by high voltage may be small, a low voltage supply can cause mputations, especially a lead acid battery. 12 volts at a 100 amps through a wedding ring can amputate that finger cleanly. That much current through a metal watch band can do a lot of damage too.

For that matter when shock is involved, the "ordinary" 120 volt circuit is more deadly than high voltage in most situations. That's because high currents stop the heart, then when you fall down the bump is a pretty good heart starter. But 120 volt shocks often put the heart into fibrillation, and in that operating mode the heart's reflexes are satisfied though it pumps no blood. 4 or 5 minutes and you're brain dead. A few more and your dead all over. You can only be brought of fibrillation with a defibrillator to give

a massive short shock to stop the heart and let it bounce into a normal rhythm again.

True, the burns from a 7 KV power line are bad but I had several clients who survived those and several families of those shocked by tools supplied with 120 volts that didn't survive. And I had to explain why in my consulting business over the past several decades. High current and any voltage demand some attention and care. Even if the shock isn't severe enough to cause major injury or heart problems the speed with which the shock can cause your arm muscles to contract and you to extract your hand from the radio can cause the back of your hand to loose much skin as it hits stuff on the way out of the radio.

Good safety rules require no watches or rings when working with live electricity at any voltage. Good safety rules require you to not work on high voltage apparatus with the power on, and after the power is off AND thoroughly disconnected in a way that NO ONE can apply power (like pull the plug and put it IN your pocket) short the power supply with a metal rod on an insulating handle, and park it there until you are finished with the work. E.g. short it and keep it shorted. And there's the old rule, one hand in pocket, one hand in circuit. That minimizes the current paths through the heart, but you can still jump fast and high without control and the bounces can get you into deep trouble, like landing ten feet from the foot of the ladder you were on.

Date: Fri, 28 May 2010 14:39:07 -0400
From: "FISCH, MICHAEL" <mfisch@kent.edu>
Subject: [R-390] Grounds

I finally moved the shack to the basement, pounded an 8' ground rod outside near the shack and I am more-or-less ready to attach a real ground wire and put up a real antenna for my 390a. Now this has lead to a question. My AC service entrance is on the other side of the basement. If I ground the input coax, then I have my receiver grounded at two places (low freq at the service entrance) and RF (but I imagine low freq also) via coax and a ground wire from my ground. This seems like a ground loop ready to happen. The pearls had a lot of good info, but I did not seem to find this one. The ideal I imagine would be to have the shack near the service entrance, or all at RF ground. I imagine that using a fireman's friend to lift all the AC power grounds and the external ground is not good practice. Also many of the more practiced people on the net have undoubtedly solved this.

My thanks in advance. Remember the soldiers that died for our freedom on this Memorial Day.

Date: Fri, 28 May 2010 18:12:17 -0400
From: Jon Schlegel <ews265@rochester.rr.com>
Subject: Re: [R-390] Grounds

What about some type of a broadband RF transformer that isolates for DC/60 Hz between your R-390A and antenna? I think that should break the loop and keep things power line safe.

Date: Fri, 28 May 2010 18:29:17 -0400
From: jrfke5ri@aol.com
Subject: Re: [R-390] Grounds

Grounding at two points is not a problem in this case.

Date: Fri, 28 May 2010 18:42:03 -0400
From: "Judi Doran" <cooner@embarqmail.com>
Subject: Re: [R-390] Grounds

Hi Mike: well, here is the deal. you really do not have a ground!! if you want a good ground you need multiple ground rods seperated by ten or more feet and connected by buried bare copper. the ground scheme here is six driven rods under the house footer connected by #4 bare copper, rods are about twenty feet apart. then a bare #4 copper about 90 feet long to our well casing. That produced a very good power ground system, about two or so Ohms. A single ground rod depending on soil, moisture, etc is in the range of 15 to 30 Ohms. A RF ground is a whole different story, use as much wire as you can find laid out on the surface or just below. My 80 meter vert and 40 meter array has more than nine miles of radials, that is probably overkill! Stretch out wires in a partial radial pattern in your yard and connect to the ground rod. Then run a heavy copper conductor or braid around the house and connect to the incoming service ground rod. Also would suggest a nice fat MOV in the service entrance box, but connect it to a two pole 50 or more Ampere breaker, your range or AC breaker. local electric supply should have the fat MOVs. Bernie W8RPW

Date: Thu, 21 Oct 2010 17:28:54 -0400
From: "Radley Smith" <wesmiths@comcast.net>
Subject: [R-390] Power line Filter

I would like to know if anyone has suggestions for replacing the power line filter, with simplicity of installation being very desirable. Are there and concerns about removing the back panel for this job?

I would probably replace the selenium rectifier with an appropriate silicon bridge and would like to know about any dropping resistor needed and others issues.

Date: Thu, 21 Oct 2010 19:06:06 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Power line Filter

The biggest concern about replacing the power line filter is the fact that the stock filter passes enough current to ground to trip the new ground fault breakers. If you run the receiver on an old style breaker with a good ground wire there is no problem.

There are several computer line filters than can be found free or hacked out of computer power supplies that will set behind the hole left when you remove the standard filter. These will filter and fit. But it is unsightly. You can remove the filter, melt out the solder to get the "can open" and re pack it with a couple caps that have a small enough value so as not to upset the GFI breaker. You can run the receiver from an isolation transformer.

You can run the receiver from a small UPS. Its input will not trip the GFI and its output will accept the line losses of the receiver filter. Do your homework and consider the caps in question are pulling power even when the receiver is off.

You can run the receiver without the filter. Or gut the filter and run the can empty.

Are there any concerns about removing the back panel for this job?

Only wire harness wire length. Better to stand the receiver on end, Pull the VFO for a bit of knuckle room and just do the rework with the panel in place.

I would probably replace the selenium rectifier with an appropriate silicon bridge and would like to know about any dropping resistor needed and others issues.

Just put the new bridge in and worry not about any change in values. Remember the load is the relay coils. These will pull what ever power they need.
As current is drawn, voltage will drop across any resistance (forward drop of diodes) in the circuit. A bridge will have a higher voltage. but the load is the same and thus the current will be lower and the power will be as it was across the coil to begin with. Other loses in the circuit will be less and this is OK. Consider the varnish insolation on the coil wire winding. As long as you do not exceed it break down value the coil will be OK. The voltage rise on the 24 volt power supply transformer will be no problem for the receiver. Lots of bridges have been installed with no other changes. They

only get used if you are doing calibration and break-in. Not a large duty cycle. Have fun

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Date: Fri, 22 Oct 2010 01:06:23 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: Re: [R-390] Power line Filter

You're one of the best on the list, so I hate to even mention this. Capacitors to not pull real power. If they did, they'd heat up. Instead, they draw reactive power which doesn't show up on a watt meter. Think of them as tiny power factor correction caps. The GFI doesn't know that the current is out of phase with the line voltage, and neither does your body when you put yourself in the current path. Your wattmeter does know that the reactive current is out of phase, so it doesn't show cap current times line volts. Years ago, when 2 mfd 600 V bathtub caps were cheap, you could use one to light a pilot lamp from 120 VAC without the heat of a dropping resistor. The lamps didn't last long if they were turned on and off frequently, due to the initial charging current if the switch closed at the peak of a line cycle. Never tried a small series R to drop the surge current, though.

Date: Fri, 22 Oct 2010 12:03:41 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Power Line Filter

A hospital grade Corcom line filter has better specs than what was in there. They are rated at either 3 or 6 amps. Add a few 130 Volt MOV's (line-neutral) (line-ground) (neutral-ground) and a CL-80 or CL-90 to limit inrush current. All of this will fit easily into the space where the old filter was.

I use the hospital grade filters as they have a much greater attenuation factor for HF noise and very low leakage current. I picked up a dozen 6EHQ3 filters a few years ago and install them in everything.

http://www.cor.com/Series/Medical/HQ/

If you look at the chart that filter attenuates common mode noise (line/ground) by 28-15 dB and differential mode noise (line-line) by 75-40 dB between 500 KHz and 30 MHz. The leakage current is less than 2 uA so you will not be tripping out a GFCI.

The original line filter in the R-390A was to eliminate generator noise and power line coupled interference from other RF gear. This was well before the days of computers, plasma screen televisions and CFL's. Our electrical noise levels are significantly higher today than they were in 1955. It only

makes sense to put a better filter in there than what was designed 55 years ago.

I like MOV's to catch the little transients that come in on the AC power. My receivers all run off of a 3 KVA UPS and sometimes the switching noise can be heard as well.

If you get into the chase to eliminate all EMI/RFI then you find yourself purchasing RFI gasketing materials, beryllium contact stock, copper tape and lots of grounding materials. Thank God my nearest neighbors are a quarter mile away so I do not need to listen to their CFL's. Long live incandescent lights!

It got so bad...<sob>, <sniff, sniff>.. I am now attending RFI anonymous meetings to quit from buying copper mesh for all of the air vents on the radio.

My upcoming book "Confessions of a Compliance Engineer" will be hitting the bookshelves in 2018.

Date: Fri, 22 Oct 2010 13:01:50 -0500
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] Power Line Filter

I have a Corcom line filter in my John R. Leary modified SP-600. I can say that out of all the receivers in the shack, it is the quietest. My noise level in very low where I live even though I live in the central part of town. Power line noise in non-existent. But, when listening to real tough dx, the Leary SP-600 hears it before the others and the audio is much clearer than others. So much for bells, whistles and modern engineering marvels. All other things being equal, it has to be the Corcom line filter. Oh, it has a marvelous product detector too, so listening on ecss isn't even an issue either. It certainly drifts much less than a Drake R7A I owned a few years back and is on par with a good R-390A as far as drift goes, + or - 200 hz from turn on to half hour. I regularly listen to ssb nets and enjoy the audio much better than the other lsited receivers. One item, I do use a Timewave DSP-599zx when the standard LC filters don't cut the mustard.

Date: Fri, 22 Oct 2010 23:35:19 -0700 (PDT)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] Line Filter

The capacitors DO pull real power, that is, when they are failing. The caps then release their magic smoke and fire. Yet another compelling reason to rebuild/replace the filter module. Goto r-390a.net and reference Wei-i Li's "Pearls of Wisdom", a treasure trove of knowledge on this topic and all

others R-390, painstakingly distilled from this forum over the years.

Date: Sat, 23 Oct 2010
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] Power Line Filter

I have installed Corcom AC units in all of my BA's. Once you take off the original 50 year old filter, just file a little to square up the round hole and the Corcom fits inside real nice. I have no problems with the minor cosmetic changes, seeing as how none of my gear is going to be judged on looks, and anyway, no-one can see it once it is in its operating position.

Electrically speaking, the Corcom just does the job IMHO.

One caveat: be SURE that the hot side of the line goes to the fuse and microswitch. That was not the case on one of my 390A's when I got it.

Date: Sun, 24 Oct 2010 15:29:36 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Power line filter, specs, datasheet

Here is where the datasheet is for the hospital grade filter. It's real benefits are for the extraordinarily low leakage current.
http://www.corcom.com/Series/Medical/HQ/

I use the 6EHQ3. Check out the specs for attenuation up to 30 MHz.

Date: Thu, 20 Jan 2011 20:10:19 -0500
From: "Michael OBrien" <mako26@shentel.net>
Subject: Re: [R-390] R-390a Question

I apologize I have miss described what I need, the A/C line filter that mounts to the back panel at the point of the power cord connection. It is marked FL-101 on the back panel and on the wiring print.

Date: Fri, 21 Jan 2011 11:22:17 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] R-390a question

I suggest replacing the line filter with something newer like a Corcom. (Tyco) We have discussed this extensively over the past two or three months and the archives are full of details so I will not belabor the point. The filter does need to handle the 2-3 amps of AC that the radio requires. Just a quick search on eBay under "Corcom" lists dozens of products for less than $20. This is a pretty standard example on eBay; 300441665554 I use a much more expensive Corcom filter that is retrofitted into several

radios (SP-600, R-220, etc...) that is hospital grade and has a great deal of attenuation up to around 100 MHz.

Date: Fri, 21 Jan 2011 12:38:23 -0500
From: "Jerry O. Stern" <jsternmd@att.net>
Subject: Re: [R-390] R-390a question

There is also this one available for $5 less that I think also has very good specs: the 3EQ1 Ebay: 220717316306

Date: Fri, 21 Jan 2011 19:54:56 -0800 (PST)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] F101

I suggest that you simply trash the original AC input module, and install a Corcom AC filter-receptacle. It takes a little filing (gasp) on the back panel. The list is full of explanations on the shortcomings inherent in F101.

Date: Sun, 30 Jan 2011 15:57:55 -0800 (PST)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] query re ground loop (OT)

I have a strange problem on my stereo. Loud interference-like mid-range pitched (not 60cps) hum when plugged in using 3 wire plug. Turned off all the dimmers in the house: hum persists.

No noise if I use just a 3 to 2 adapter thus ungrounding the amp. Putting the amp on an AC receptacle in another room: no hum. The offending receptacle itself is grounded properly insofar as I can tell.

Do I have some sort of ground loop? What is wrong with my thinking?

Date: Sun, 30 Jan 2011 19:02:38 -0600
From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] query re ground loop (OT)

>.....Turned off all the dimmers in the house: hum persists.

Likely ground loop - but only a "hands-on" determination could confirm it - and that it's not some sort of "Current Carrier" effect...

> No noise if I use just a 3 to 2 adapter thus ungrounding the amp.
>Putting the amp on an AC receptacle in another room: no hum.

Sounds like something that is plugged (audio connection) into the amp (when humming) is plugged into a different AC outlet that is on the

opposite "leg" (or majorly different loaded circuit) in your house. Not knowing what the configuration is - hard to say where to start - other than I'd un-plug each component (both connectors in the case of stereo connections) one at a time to see if you can isolate which component is causing the problem - and see if it's on
an outlet on "the other leg, etc."... Of course - not to be overlooked - the amp itself could be on an outlet that is different than the "rest of them"... in which case an extension cord might be in order (to get it on the same side of the circuit).

If it is indeed just one component that's on a different circuit - one could either run an extension cord to that device - or get an isolation adapter to go between the audio connections of the device and the amp.

Date: Sun, 30 Jan 2011 23:14:21 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] query re ground loop (OT)

Do the standard trick: stand at the circuit breaker panel having arranged a way to hear the offending sound. Turn off every breaker one at a time to locate some culprit. The list of appliances and other things that can cause such troubles is too long to remember, but it included washing machines!

> The offending receptacle itself is grounded properly insofar as I can tell.

OK , but maybe not. A DMM will help you, or spend the modest money for an outlet tester. I suggest one that has the GFI outlet test button.

Date: Sun, 30 Jan 2011 22:34:27 -0800
From: "Chris Kepus" <ckepus@comcast.net>
Subject: Re: [R-390] query re ground loop (OT)

It sounds to me that you isolated the problem: "No noise if I use just a 3 to 2 adapter thus ungrounding the amp. Putting the amp on an AC receptacle in another room: no hum." I do not pretend to know how to suggest ways to "elegantly" eliminate the ground loop, but since you accomplished the mission, what's not to like? Simply use the three prong to two wire adapter. Just for a safety check, you might take a VOM or DMM and see if there are any AC voltage potential differences between your amp chassis and the chassis of other components.

Date: Mon, 31 Jan 2011 12:14:47 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] query re ground loop

With the switchover to a two prong connector you have pretty much

narrowed
it down to a ground loop.

In the circuit box the neutral (white) and ground (bare or green) wires will be bonded together. It they are also bonded together in the radio chassis it is a ground loop but not one that I would have expected to be noticeable. Ideally the hot and neutral conductor in the radio should go to the line filter, power switch and power transformer only. The ground wire should go to the chassis. If this problem recently appeared you may have "something" in the receiver that is leaking to chassis ground. Since you are getting by with a two wire adapter the radio can function but it still is not a good thing. Try to use a voltmeter to measure the potential between chassis ground and the grounding pin at the outlet.

I will give an example on why you do not want to let this go on unaddressed; My Dell laptop power supply was attached to the wall when I took a lightning
strike at the house. The laptop was not attached at the time and when I plugged it in things worked fine. One unpleasant experience was that the plug to my laptop suddenly had a partial AC potential on the barrel of the connector. It was not an issue unless I swapped laptops from my personal D800 (plastic case) to my work laptop with a metal case. If I was using the laptop in my "lap" (on bare legs) it would give me an unpleasant shock. Being naturally lazy I put it low on my priority list of things to replace. I just learned to use something as an insulator between leg and laptop. The downside was that the problem in the power supply did not get better. Finally this last fall it went into a full fault and put 120 VAC on the laptop and blew out the motherboard on the laptop when I plugged into an external monitor.

I suggest trying to figure out exactly what is causing the hum on the radio before you (or your child, spouse, dog, etc..) completes the circuit to ground.

Date: Sun, 6 Feb 2011 19:46:08 -0800 (PST)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] ground loop solution

Firstly, thanks to all who offered opinions and advice re my problem. To reiterate, the hot and neutral AC supply lines were not crossed. The 3 to 2 AC adapter was put away in my toolbox. What I did do was get a small audio 1:1 isolation transformer advertised as a *ground loop isolator*, and said to have wide frequency response. It is sold in car stereo shops for around $20.
It worked eliminating 95% of the annoying noise.

Date: Sun, 06 Feb 2011 22:14:05 -0600

From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] ground loop solution

You're welcome - and glad my last suggestion proved to be helpful...

Date: Mon, 7 Feb 2011 20:51:51 -0800 (PST)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] ground loop solution

Good suggestion. The $20 is not a lot to spend for a solution complete with connectors. But if you are a cheapskate like me, there is a good solution available from common salvage. This would be the telephone line isolation transformer taken from a scrapped modem. I have used these to good effect for audio isolation. These are 1:1 with a rated impedance of around 600 ohms. I tested one at a level of a few dBm and it was flat within about 1 dB from 20 Hz out to 60 KHz.

Date: Tue, 8 Feb 2011 10:33:03 -0800 (PST)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] ground loop solution (OT)

Now that is thinking smart. Could have saved me $20 as I have a stash of RCA connectors too.

Date: Tue, 08 Feb 2011 19:42:58 -0600
From: Tom Frobase <tfrobase@gmail.com>
Subject: Re: [R-390] ground loop solution

Or you could have used the line output which is balanced 600 ohm already.
...

Date: Wed, 23 Feb 2011 16:49:53 -0500 (EST)
From: wa4aos@aol.com
Subject: [R-390] R 390A Line Filter Trial

I am putting a kit together to replace the old leaky Corcom line filters used in the R 390A's with new Hospital grade Corcom filters. The problem is mounting a good quality filter with better specs than the original within the existing real estate. I came up with a solution using existing holes, a mounting plate with standoffs. This is a very tight fit but easy to install. The filter will mount behind the PTO and is raised above the wiring harness runs in the rear. A rubber hole grommet comes with the kit to feed the line cord to the filter. The filter will additionally include 3 Varistors and a CL-80 current limiter already installed. I was not able to find a Corcom or any other line filter solution that would mount where the

original filter mounted but this solution is VERY WELL DONE and commiserate with the excellent quality within the 390A Receiver. All kits will be pre assembled, tested and burned in for at least 1 hour before shipping.

My prototype filter kits are installed in three R 390A receivers presently and the installations were perfect as well as professional looking. I am looking for 5 volunteers who have R 390A receivers to take a kit at MY COST, install them and give me feedback. Already, I know the kit fits into Motorola, Amelco and EAC R 390A's. I would like to hear from folks who have other built R 390A's for the trial. I prefer engineers, technicians or competent long term users of R 390A's for the evaluation trial period. No skills beyond operating a screwdriver are required but I am looking for professional feedback.

Of course, the usual warnings about working with any line voltages apply.You know, unplug the receiver first, capacitors hold charges, wear goggles, gloves, hazmat suites, rubber souled shoes, have 911 people online the entire time you work, seriously they love R 390A's too, and all of the usual safety stuff we all practice daily.. Oh, keep one hand in your back pocket and a carrot in your left ear too. So, if you electrocute yourself to death during installation, don't sue me because you weren't' warned. Actually, I would prefer not hearing from you if you kill yourself putting this kit in... Just saying..
.
Later, I will offer these kits to users of this reflector ONLY, at a discount for a short period of time before I list the kits on eBay and my website. I would like the filters kits installed and reports back within a month. Please don't request a trial filter if you are NOT SERIOUS about quickly installing it and reporting your observations to me and the users of this reflector. if there are any unforeseen issues, let's find out now..

Installation is simple and should not take more than an hour; instructions will be included. You simply remove the bottom cover and the old Corcom filter. Mount the hardware to the chassis and install the filter, No soldering will be required. The kit will also include a new line cord and plug with the aforementioned mounting parts. So far, I see no reason why this kit would NOT fit into any iteration of the R 390A receiver but there are some minor variations in machining.

If all goes well, I will offer these to reflector users around the first of May. I am having the small chassis plates CNC machined this week and should have them next week. I will offer a full refund including shipping to the participants of the trial evaluation if not pleased with my kit or certainly if it will not fit some variation of machining within the R 390A. I plan to post some pics in the next week or two for others to view. Additionally, I

will post some pics of line hash in and out of the filter.

The evaluation will help me understand any installation issues before listing these kits are offered to the general boat anchor community on eBay and elsewhere.

Please don't beat me up about changing the looks, or the filter isn't necessary, or it's not original,. or why didn't I choose a so and so filter. If you have a better mouse trap, build it. I gotta tell you, it was very time consuming to fit this or any other filter in the prototype stage. My first 5 ideas and attempts did not work out for one reason or another.

From my perspective, the kit is 100% reversible, prevents people from getting shocked due to differences in potential between the 390A chassis and ground. I also strove for this to be a professional solution and not be a Micky Mouse, kludge attempt at fix something; I see my share of sorry mods almost every week. I treat these receivers with great respect and am trying to help with a known problem.

Thanks in advance for reading this post and your assistance to help with this project. If you think you might want a filter kit in May, please hold off letting me know until the trial is over. As with the Fowler manual copies I sold to readers of this reflector last summer, about 120 something copies all over the planet, I will make good on my offer to list these kits here at a discount for a short period of time.

If you are interested in a trial kit at my cost, will install it quickly, report your observations and are technically competent to electrically and mechanically critique this kit please contact me at my email address listed below, Additionally, first consideration will go to owners of 390A variations other than Motorola, Amelco and EAC built 390A Receivers. Tell me which 390A you have and a little about your capabilities.

Date: Thu, 24 Feb 2011 08:27:34 -0800 (PST)
From: Rasputin Novgorod <priapulus@yahoo.com>
Subject: [R-390] isolation transformer

> The only safe way to use these receivers is with an isolation transformer.

On my test bench, to power test subjects, I have a Sola, medical grade, isolation transformer. It feeds a variable transformer that gives 0- 140 vac, so I can soft start things. I can also switch, in series, a 60 watt light bulb for current limiting.

Recently, I found a ground-fault outlet. You know; they go in bathroom outlets to pop, & kill your razor, should it be shorted.I was thinking of

using it as my test setup outlet, to indicate a ground-faulted test subject.

I was also considering a grounded wire with a heavy alligator clip, that I could clamp onto an ungrounded chassis (i.e. two-wire power corded). However, I've
been told that some gear, especially some test gear, is intended to have chassis floating, and can be damaged if referenced to AC ground.

Is this a good idea? Any advice, corrections or improvements to my "test power" would be appreciated. I think I'll add a 5(?) watt breaker, to pop before the shop fuse. I mostly work on older HP test gear, and boat anchors, including my R-390a.

Date: Thu, 24 Feb 2011 11:04:54 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] isolation transformer

If you wanted to use a GFCI to test for ground leakage but did not want to potentially damage a radio due to a direct connection to ground you could always make that temporary connection to the GFCI ground through something like a 10 Kohm resistor. There will be enough current to trip the GFCI. Giving you an indication of leakage current but not enough current to damage anything in a radio that would be that sensitive to a grounded chassis. It is better than licking your finger and touching the chassis to find out if you get a tickle.

Date: Tue, 22 Feb 2011 15:19:19 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Voltage Reduction Scheme

> <SNIP> This is another one of those "poorly" thought out schemes. There is NO infrastructure in place for electric cars. It would be far easier to go the path of LPG or H2 stations, and less upsetting of the remainder of an electrical distribution system that is essentially a house of cards waiting to sustain MORE and LARGER failures.

> With hybrid or battery-only vehicles becoming more common, loads from
> charging them are now beginning to be examined by utilities, and they
> don't like what they see. There's an article on p. 23 of the latest ECN
> (http://www.ecnmag.com/) titled "Challenges of charging plug-in hybrid
> electric vehicles" that is worth reading. The author says that every
> vehicle being charged at Level-2 specs adds a load equivalent to 1 to 3
> houses for the duration of the charge. That's going to heat up a pole pig
> PDQ.

The power companies don't look beyond their distant and closed in control

centers. They really don't have ANY idea what it is like out beyond their "collective" instrumentation. They should have to work out on the lines for a few years, along with a power plant history under their belts BEFORE they are even allowed to be an apprentice in a control room.

> I've seen the effects of our local powerco changing transformer taps and/or
> doing power-factor correction changes during the day. That was a major
> reason for our getting a 100 KW UPS for our datacenter at work. Before
> the UPS, every little glitch would knock the mainframe and some number of
> servers right down. After the UPS, I get an E-mail message when the powerco
> decides to do the nasty, but things stay up.
<SNIP> > Car charging is going to make for some really interesting copper losses.
>
> All of this, of course, will make for interesting voltage excursions at the
> wall socket if it isn't kept well under control. Maybe a 3TF7 or other
> voltage regulator will turn out to be useful. ;=)

I don't know where this is all going to go. I don't see inner cities undertaking tearing up the street and sidewalks to put the "charging stations" in place at the curbside parking places. There certainly is going to be NO stomach for after construction modifications to parking garages. All the structural engineering has already been done to tackle the ability to withstand the weight of the vehicles, worst case - all SUVs - that they aren't likely to remotely rebuild to taken on the added structural loads of the power transformers and "stations" for charging. It's gonna be fun, you bet!

Date: Thu, 24 Feb 2011 13:08:41 -0600
From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] electric cars

I'll also be brief - Mississippi Power is taking it seriously - though only as part of an overall plan to meet demand "down the road". With the difficulties in building new Nuc plants - they have decided to make maximum advantage of Mississippi's natural resources - and are pursuing a plan of building several power plants right at coal fields - and using state-of-the-art gasification processes that result in (comparatively) low emissions. The are also embarking on a system wide upgrade of equipment and personnel training for "intelligent grid" management that gets the power where it's needed in the most efficient way possible. One thing mentioned here was that you can only raise the voltage so much before things go bad. That's true as far as ultimate delivery is concerned, but not

with distribution. What Mississippi power is doing - is upgrading their equipment to handle way more voltage than it could originally. This includes upgrading insulators, switches, reactors, etc. - and of course transformers. By upping the voltage considerably - at the current demand levels - it significantly reduces the amperage their distribution system must deliver (which is the real issue in losses) - and as demand increases over the years - the system will be able to handle that within it's "current" capacity. They are installing a massive amount of fiber optics so that they can "look" at their system right to the meters - (and even read many of those meters without someone having to physically do it)... and adjust their system to best efficiency.

Now this isn't as far off topic as one might initially think: we enjoy using our radios - including our 390A & 391. Directly across the street from our house is a primary incoming distribution feed for the downtown area of the City of Meridian - running at 100KV. Until Mississippi power started this upgrade - the leakage along that line at times made any serious reception here impossible (even seriously impacting local AM broadcast stations at times). Once they
upgraded the insulators, etc. on those lines - interference dropped dramatically - often less than from "other" local noise sources. They even "survey" their distribution lines every-so-often to make sure everything is OK... This caught our attention - and it comes through (seems like) about once a year... http://www.glimpsesofmeridian.com/gom-14.html

Coming back to the electric car "thing"- there is always an option to run higher voltages into locations - as needed - stepping those down "on the spot" as needed. Higher voltages (seriously higher - not the 130V vs 120V kind - but more like 13.6 KV vs. 7800V). That "step" alone cuts the current by roughly 40% to deliver the same KWH... So some people may have a "purpose built" polepig in their garage to charge the car(s) - which would have little affect on the
neighbors... just my .02

Date: Thu, 24 Feb 2011 14:23:47 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] electric cars

My original higher voltage issue has NEVER been intended to squawk about long transmission lines. It is the "local" transmission lines in neighborhood distribution systems. That is the crux of the matter. This "segment" isn't being kept up to date with larger conductors, only "jacking" the voltage higher. This is why you will see the 127VAC at YOUR receptacles.

This "power plants right at coal fields - and using state-of-the-art

gasification processes that result in (comparatively) low emissions" is not exactly new. The Canadians have been doing this for awhile! The corporations here keep getting their attempts "choked" by "those that make the laws". This gets into politics - I WON'T GO THERE!

Date: Thu, 24 Feb 2011 14:43:48 -0500
From: rbethman <rbethman@comcast.net>
Subject: [R-390] OT - Transmission lines - local

This changeover began a couple of decades ago. It used to be that "local" lines carried 4160/2400 in a "Y" configuration. Delta was provided for commercial locations that had 3 phase requirements as needed. Then there began a "feeder" by "feeder" transition to 12470/7200.

The conductors were NOT changed, but by tying a second insulator in series with the original single, they would change out the pole top transformer. As they did this, they began the path to the increased voltage supplied to residential customers.

One thing I was involved in while still in Uncle Sam's employ, was to perform annual Infrared scanning of these systems. Uncle got "smart" and figured out it was a whole LOT cheaper to locate problem areas by locating the connections that were WELL over the "normal" temperature of the "system". It has saved a LARGE amount of $$$ to have these problem spots noted, and let them schedule the required maintenance in lieu of the damaged/destroyed equipment, outages, and over-time paid to their crews.

Finally, my "local" municipality has acquired such equipment. They have been contracting it out. I've offered to go along with them when they begin on their own, but haven't heard back. Oh well, their loss!

From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] OT - Transmission lines - local

Interesting story about 4160 volts.

Several years ago when I was still an electronic controls technician for the government at Keesler AFB, we had a couple of chiller plants that had 4160 running to the chiller control panels and then was stepped down to 120. We would always caution the new airmen not to carry a voltmeter into the switchboard area as they might be fooled into thinking they would do a "simple" voltage check. One did one time and that Fluke destroyed itself and burned him too. We would call out the line crew and let them check the 4160 fuse panels with their rubber and leather gloves and the buck roger ray gun that indicated voltage. It was usually one leg down and we couldn't get good readings inside our control panels. We never messed with

that stuff. We worked up to 660 volts, nothing higher, that's what they were for. Nasty stuff!

Date: Thu, 24 Feb 2011 17:37:16 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] OT - Transmission lines - local

The 4160/2400 was always "fun"! Our emergency generation equipment produced that for output. We had one of our *OWN* techs not watch what he was doing with a Simpson 260 one day.

The PT, (Potential Transformer), used for metering to the control panel was producing erroneous output. Said *tech* used the 260 - BUT - connected it across the HIGH Side in lieu of the low side. Needless to say, the Simpson wasn't to enthused about the 2400VAC. The tech was "squatting" with the meter just below the "beloved *jewels*". Sort of removed the clothing in that area as the 260 went POOF!

NEVER make an assumption that even someone that went through the SAME training YOU did *will* keep his/her mind adequately focused on the task at hand!

I happened to a few feet away. I knew what he was looking for - BUT - I had NO idea where he was reaching with the probes!

Date: Thu, 24 Feb 2011 17:07:38 -0600
From: Robert Nickels <ranickel@comcast.net>
Subject: Re: [R-390] OT - Transmission lines - local

Yup, and if you have any doubt as to *how* nasty, watch this:

http://www.youtube.com/watch?v=-Qq7U7tFsvQ

Date: Thu, 24 Feb 2011 17:07:37 -0600
From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] OT - Transmission lines - local

Sea story (but unfortunately a true one): Aboard my last ship (that sounds better than "only" ship - but then again I was aboard 53 months)- the highest AC voltage we had to deal with was 440 - tons of current - but 440. I've seen electricians pass their fingers down a row of fuses - looking for the one that had "juice" across it... Usually the 120 didn't get much reaction - but if they caught a 440 bus - usually they'd let out a cuss word... but then just go on and replace the fuse. DC was another matter... There was a 500VDC bus that carried sizable current here and there - never knew what it was for - though some of the old timers claimed that during combat in

WWII - welders could plug their stingers directly in and do on the spot repairs. I can't imagine welding with that much voltage and current (the conductors were in the multiple aught size). What was really dangerous, though was the propulsion bus... Three 2875 horsepower 16 cylinder diesels turning generators that put out "nominal" 500VDC @ 2000Amps. Those three generators would be placed in *series* to drive the four electric motors that actually turned the shaft (actually two shafts - the above is a description of one engine room - the other was identical - except one drove the port prop and the other drove the starboard prop.). In 1972 the entire ship was "re-engined" (main propulsion and Ship's Along Sides generators were 8 General Motors Model 16-645E5s; Ship's service were 2 General Motors Model 12-645E5s) - the generators and motors reworked, and all of the switch gear updated, etc. While testing the main propulsion generators and switchboard under full load (talk about some big resistors - the load cells on the boat deck could dissipate some 6 million watts -- we could push them very nearly to that!) - there was some "issue" with one of the switches (imagine a switch able to switch a generator in / out of a loop with 2000+ amps and approaching 2000Volts *DC*!). One of the yard workers was trying to watch the mechanism while the switches were being thrown - and as he was leaning around the back edge of the switchboard - he apparently lost his balance - and without thinking - just instinctively reach out to steady himself... When the body bag was passed up the access ladders - we only needed one hand to pass it along... Be careful out there... That stuff is called nasty for a reason...

Date: Thu, 24 Feb 2011 16:36:33 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R 390A Line Filter

This is the ORIGINAL description: I am putting a kit together to replace the old leaky Corcom line filters used in the R 390A's with new Hospital grade Corcom filters. The problem is mounting a good quality filter with better specs than the original within the existing real estate. I came up with a solution using existing holes, a mounting plate with standoffs. This is a very tight fit but easy to install. The filter will mount behind the PTO and is raised above the wiring harness runs in the rear. A rubber hole grommet comes with the kit to feed the line cord to the filter. The filter will additionally include 3 Varistors and a CL-80 current limiter already installed. This should answer your question.

Date: Thu, 24 Feb 2011 19:28:05 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] OT - Transmission lines - local

There is NO question that HV is nasty stuff! Our team was selected to install a "small" 750KW unit to provide for emergency power to the U.S.

Embassy "compound". We had gotten through the entire installation. It was time ti light it up and test it out. That was when the *fun* began! We started it up and brought it up to speed. The automatic Field Flash kicked in. Little did we know that Depot had overlooked one little item. The generator's *diode* that spun on the rotor was an antiquated selenium rectifier. Well, it decided to let go just then. The remainder of the team hauled rump out the business end door. I hauled rump forward to hit the emergency shutdown. It was VERY disconcerting to see the 4160/2400 crawling all over the outside of the "normally confining" HV enclosure. Personally, I'll pass on EVER seeing THAT sight EVER again. Nasty is putting it mildly! They picked one of "our" teams due to the specific country we were installing this in. The going and coming was interesting in and of itself. <GRIN>

Date: Thu, 24 Feb 2011 20:58:16 -0600
From: "libbysales" <libbysales@austin.rr.com>
Subject: Re: [R-390] OT - Transmission lines - local

440 ?... no single AC fuse in this set up is or has 440 volts potential to ground or neutral, 440 volts AC is the phase to phase resultant voltage, the single fuse would represent the product of the Sq root of 3 or 254 vac or approx ..mac/mc

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Date: Fri, 25 Feb 2011 00:38:36 -0600
From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] OT - Transmission lines - local

Ok, I hear the grumbles - so my last post on this...

.....that's a cool million/ watts.

Actually - a bit more... At sea our normal "ahead standard" was 112 turns on each
shaft... which just happened to push us through the sea at roughly 12 knots. At that speed (roughly 57% of Flank- or maximum effort) the generators were putting out roughly 1060 volts @ 1414Amps - or roughly 1.49MWatts (per shaft,
remember). Flank - which pushed the plants to capacity - was "rated" 1500V @ 2000Amps per shaft... or 6.0MWatts (combined both shafts) - which in "theory" should have pushed us to 22 knots - but the best we achieved was 21knots. BTW - the entire loop had a combined series resistance (motors, switches, buses, etc) of .75ohms (that's *point seventy five* ohms)....

Sorry if these "off topic" posts perturbed some folks - in talking about the ship's propulsion systems, etc. - but I must note - while this part of the ship

was shoving it's 19,000 tons of "us" around and supplying 120Volts to various equipments - those equipments included a goodly number of R-390As which were still very much in use. So while that ship's propulsion and ship's service generators may be "off topic" - it was the environment and use that the R-390/A/1s were designed and meant for. So if that part of their history is boring, sorry... but the fact is - it IS part of these radio's heritage...

Date: Fri, 25 Feb 2011 02:00:54 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] isolation transformer

> ... use a GFCI to test for ground leakage ... you could always make that >temporary connection to the GFCI ground through something like a 10 Kohm >resistor.

I'm pretty sure that Tisha's suggestion is based on the fact that (most/all) GFCI detectors in the US are set to trip at about 5 ma AC of leakage - that is UNbalance in the line and neutral wires. So, a 100K resistor might now work.

Date: Fri, 25 Feb 2011 02:36:37 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] isolation transformer

> 100K resistor might now work.

I meant to write might NOT work.

Date: Mon, 28 Mar 2011 10:24:08 -0700 (PDT)
From: Steve Toth <stoth47@yahoo.com>
Subject: [R-390] High Electrical hash noise level

I'm experiencing significant noise coming over the 120 volt AC line (S9 levels) when the house gas furnace turns on. I thought that the noise was originating in the blower motor. It turns out the noise is being generated when the gas burner is "on". As soon as the burner switches "off" the noise stops. The furnace is a late model Trane gas furnace with an electronic control board and thermostat. When the furnace burner is "off" the noise levels are minimal.

My station is on the second floor of the house. I have so far installed a common ground buss bar for the equipment and a ground connection to the electrical system via copper plated pipe strapping (1-3 ohms per my digital meter). Tisha has generously offered some grounding system suggestions based on what she has done at her QTH; and the next step,

based on my location, is an outside ground connection using two inch copper strap, a system of several two foot ground rods and a four foot by twenty foot ground screen with all connections brazed or soldered.

The R390A that I am currently using is one that Rick Mish reman'd and has the stock line filter installed and i have added a CL-80 in series with the hot side of the AC line.

The antenna is currently an end fed random length wire strung along the railing of the upper house deck with ground counterpoise wires cut for the 80-10 meter ham bands tuned with an MFJ-931 artificial ground system to cancel ground lead reactance.

I'm thinking perhaps a good medical grade line filter some additional MOV's (if the list member putting together the line filter kits needs another test site, please shoot me an email off list - I'll pay for the parts and shipping),and a balanced antenna system away from the house might solve the noise problem.

Has anyone else experienced a similar noise situation when installing equipment What kind of steps did you take to eliminate the noise coming into the receiver on the electrical wiring What suggestions might work

Thanks for any input!

Date: Mon, 28 Mar 2011 13:37:38 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] High Electrical hash noise level

You are "experiencing" the *NEW* wonders of the "no pilot flame" methodology!
You would have to find some way to shield, and filter the furnace burner electronics, and associated assembly. These things are like the ignitors in a turbojet engine, EXCEPT, they don't shutdown even when the flame is lit. My first experience with this sort of thing happened in 1980. I replaced an electric range top, with a *NEW* pilotless gas stove top. Everytime the wife would tyrn on a burner, I'd get snap-snap-snap UNTIL she got it lit and released the spring loaded knob. You may want to contact your Trane tech folks!

Date: Mon, 28 Mar 2011 13:48:56 -0400
From: William A Kulze <wak9@cornell.edu>
Subject: Re: [R-390] High Electrical hash noise level

I was wondering about that. I don't think my new propane boiler does it, but I've got a propane "salamander" type heater that the igniter continually

clicks. Picked up by the radio, but through the antenna, I think, and not the power circuit. Noise blanker killed it.

Date: Mon, 28 Mar 2011 14:06:23 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] High Electrical hash noise level

In my case, I was getting it through the power circuits. Drove me batty! In Steve's case, he going to need some assistance. Someone with a "Selective Frequency Voltmeter", such as an HP-312 is one way to "track". A handheld battery operated shortwave radio. Go around the power panel - AFTER seeing how bad it is near the furnace. Disconnect the R-390A antenna, and just leave about a two or three foot jumper in the shack attached. *IF* that still gets the hash, remove it and listen again. Steve - If you have an oscilloscope, OR one you can borrow WITH the owner, check the power receptacle where the R-390A is plugged in. Ultimately, he's going to have to get Trane involved.

Date: Mon, 28 Mar 2011 11:15:58 -0700 (PDT)
From: Steve Toth <stoth47@yahoo.com>
Subject: Re: [R-390] High Electrical hash noise level

Step one completed - emailed Trane via their website.? We'll see what they come back with. I'll pull out my Radio Snack WWV radio and sniff around the furnace and electrical Panel. I'll also try the short piece of wire on the antenna connection; and check the line with the oscope to see what I've got. Good ideas, thanks.

Date: Mon, 28 Mar 2011 14:21:10 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] High Electrical hash noise level

The reason for suggesting something like an HP-312, is you "may" be able to locate a "high concentration" of the hash in a "band" of frequencies. That would at "least" give you a chance to build a blocking filter. It comes down to "Been there, done that. No T-shirt!". All I managed was a WHOLE stack of dirty words! LOL!

Date: Mon, 28 Mar 2011 11:39:21 -0700 (PDT)
From: Steve Toth <stoth47@yahoo.com>

I'll have to find out if anyone (like maybe the Trane servicing dealer whom I think Trane is going to end up referring me to) has something equivalent to an HP-312.? The noise seems to be very broadband in nature though - no matter what frequency I have the R-390A tuned to, the hash just drowns out any signals, so I'm thinking it is electrical.

At least with the suggestions so far I'll be able to determine if the noise is electrical in nature and just traveling through the wiring, or it's RF using the house wiring for an antenna.

If it turns out to be very broad band RF(which is possible since it has to do with the igniter in the furnace and could be acting like an old spark gap transmitter with no tuned circuit), I?was looking around on the web this weekend and came across the Timewave ACN-4 Noise Canceller - it picks up noise on it's own antenna, shifts it 180 degrees out of phase, then combines it with the original noise to eliminate it.? The article I read by a ham who installed one was favorable.? It's one possible idea if it turns out filtering won't work.

Date: Mon, 28 Mar 2011 13:26:31 -0700 (PDT)
From: Steve Toth <stoth47@yahoo.com>
Subject: Re: [R-390] High Electrical hash noise level

Here's the latest: I did some digging on the internet. Turns out this problem has been around since 2006 with Trane and American Standard Hi-Efficiency furnaces. The source is the fan inducer motor - they went to a new design of the motor they used. It generates strong RFI (S9 levels) from the broadcast band all the way up through VHF and UHF - wipes out AM radios, TVs, routers, etc.

Trane is apparently aware of the problem. They have a shielded cabling kit that can replace the inducer motor wiring harness which acts like an antenna.

I called the servicing dealer and the "technical expert" phone rep I talked to was clueless. After I told her the exact problem, the source of the problem and the factory fix for the problem (with part numbers) - with her taking notes - she put me on hold. She came back online after talking to someone to tell me "yes, there was a wiring kit that they could install but it may or may not eliminate the problem."

>From what I researched, it appears that the shielded harness sometimes solves the problem and sometimes does not. But from what I could tell from the posts I read, it looks like it really depends on what kind of RF ground is installed on the shielded harness and furnace and how complete the shielding is on the inducer harness that determines how effective the fix is. If the installation of the shielded harness works the noise level has been reported to drop to minimal levels. Right now the furnace has an electrical ground but no RF ground, so it appears I'm going to have to install one.

The dealer service manager is supposed to call me back and let me know what they can do for me.

Date: Mon, 28 Mar 2011 17:02:19 -0400
From: Al Parker <anchor@ec.rr.com>
Subject: Re: [R-390] High Electrical hash noise level

I sympathize with your dilemma. But, isn't it so that the manufacturer of a device must comply with FCC rules regarding interference, particularly to a licensed service such as amateur radio? A similar, but more widespread, problem has occurred with BPL. If you don't get relief from the dealer/mfgr, alert the ARRL, their tech. group might have some ideas, and their legal group has been involved in this sort of thing. You should not have to buy any special
filters, etc., to be able to use your equipment. If there is widespread evidence showing a known and ongoing problem, I think you've got some strong grounds to stand on.

Date: Mon, 28 Mar 2011 14:23:38 -0700 (PDT)
From: Steve Toth <stoth47@yahoo.com>
Subject: Re: [R-390] High Electrical hash noise level

I believe you are correct and this could be defined as a factory defect for the furnace.? Contacting the ARRL is a good idea - I hadn't thought of that. I was able to find quite a few threads on the internet by searching on "radio interference Trane furnace", so you're probably correct about the strength of the claim also. I just think it's kind of crazy to have one of the most sensitive receivers ever designed, if not the most sensitive, and have it knocked completely deaf by a "eco-friendly" design flaw in a furnace.

Date: Mon, 28 Mar 2011 15:33:08 -0600
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] High Electrical hash noise level

I agree with Al. But I'm not an amateur operator, but listen to a lot of different frequencies, and have no problems anymore. I've been down that road, and can tell you that Trane is one of the worst offenders. I worked in the industrial air conditioning controls field for many years. The simple solution is to buy Rheem. I know it isn't that simple with an investment with Trane of whatever you are presently using, but it's the correct answer from a technicians (retired) viewpoint. Down here on the Gulf of Mexico the a/c pretty much runs tear round and the odd days of heating, no noise from the Rheem, nada, nothing.

Date: Tue, 29 Mar 2011 09:31:11 -0400
From: Curt Nixon <cptcurt@flash.net>

Subject: Re: [R-390] High Electrical hash noise level

What the heck kind of motor for a blower does that? I haven't seen alot, but the ones I have seen are small 1/30HP reactance limited, induction motors that run at 3000 RPM direct drive to the draft inducing blower..usually a centrifugal or squirrel cage type. Has trane gone techno and put in a brushless motor that requires a switching PWM drive or similar? Surely no brushes. But if it is a drive type PWM or vectored-flux motor, it could be the drive making the noise, not the motor. Unless the motor just has some resonant condition where the windings radiate at the switch freq or harmonic.

Date: Tue, 29 Mar 2011 09:16:20 -0700 (PDT)
From: Steve Toth <stoth47@yahoo.com>
Subject: Re: [R-390] High Electrical hash noise level

I did a little scanning on the net for info on Pulse Width Modulation and you are probably correct about the use of a PWM drive. I still haven't heard from Trane or the Dealer but from my very limited knowledge of PWM and what I found on the net, it appears what Trane is using is a Direct Torque Control PWM controller on their fan inducer motor. From what I read, this type of PWM is directly related to Delta PWM that generates a full spectrum noise (no particular harmonics) sawtooth wave shaped into an AC voltage sine wave format within certain limits and is used to drive AC motors. This would explain the hash all over the spectrum.

Also, you can actually hear the pitch of the noise change (which I would think would be the changing of the sine wave format) as, from what I would guess, is the controller calculating the changes for the characteristics of the motor voltage to match the fan's load prior to the main furnace blower turning on.

You know, this is actually kind of like an ignition noise problem from the days when we had contact point ignition systems that generated interference in our car AM radios. A viable solution to this might be in my 1964 ARRL Radio handbook! If I remember correctly it was basically 1.) bypass every wire in sight, 2.) shield every wire in sight, and 3.) thoroughly ground the shields.

Which, when you think about the age of the R390A is sort of actually appropriate in an ironic sort of way....

And, of course, the simplest solution is just turn off the furnace when I have my radio equipment on the air! ; -)

Date: Tue, 29 Mar 2011 12:36:27 -0500

From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] High Electrical hash noise level

FYI, I have a desk top Halogen light with a wall wart and it wipes out my FT-1000 MP with all of the filters in use.

Date: Wed, 30 Mar 2011 01:16:00 -0700
From: Robert Moses <rhmoses@earthlink.net>
Subject: Re: [R-390] High Electrical hash noise level

Small disk ceramic caps across the motor, etc may also be helpful since these look like a short at RF .

Date: Wed, 30 Mar 2011 08:18:46 -0700 (PDT)
From: Michael Student <w7ms20wpm@sbcglobal.net>
Subject: Re: [R-390] High Electrical hash noise level

Good Luck, You're never going to eliminate the RFI from the PWM motor and drive circuitry. The layout of the contol board and the exhaust motor was accomplished with no concern for ground loops, shielding, etc. If you have metal duct work in your HVAC system it serves as a fantastic radiator for all of that noise being generated from the furnance. As for me 160 and 80 are useless when the furnace is running,40 and up is OK. One amateur suggested I install a remote kill switch for the furnance in the radio room :-).

PS. I built my own shielded harness, no effect,ferrites, no effect, lifting safety ground from motor, some reduction but the motor housing is now not NEC compliant!

Date: Wed, 30 Mar 2011 09:47:00 -0600 (MDT)
From: Richard Loken <richardlo@admin.athabascau.ca>
Subject: Re: [R-390] High Electrical hash noise level

> in the industrial air conditioning controls field for many years. The
> simple solution is to buy Rheem. I know it isn't that simple with an

I agree with Les. I have a Rheem furnace I have no RF noise from the furnace at all. I have other issues: street lights, the neighbours' TVs, laptops, complact flouros, whatever but my furnace is very well behaved. This was not due to a careful and thoughtful installation because the installer could not find his ass with both hands so I have to credit Rheem with the furnace's good behaviour. Oh, and Les, I don't own an air conditioner but I have been know to use the furnace during every month of the year.

Date: Wed, 30 Mar 2011 19:36:20 -0400
From: "Harold Hairston" <K4HCA@windstream.net>
Subject: Re: [R-390] High Electrical hash noise level

A bit over 20 years ago, we retired and built out final home. We installed two Trane Heat Pumps. A couple of months later when the Ham Shack got populated, here came the "Hash". It was sectionalized to the blower motors in the air handlers. I don't remember if it was isolated to heat or air mode. A call to the trane engineers in Dallas resulted in Trane installing two new RF free blowers. I recently replaced one of the original systems and it is RF free.

Date: Wed, 30 Mar 2011 18:38:42 -0600
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] High Electrical hash noise level

If people that own these Trane units with the rf hash problem raise enough cain, like Harold did, they would get it done gratis. My new (less than 3 years old) Rheem SEER 16 heating and cooling unit has the same type of motors, but is RFI free. Just a better design I would think. Trane makes good stuff, but in the industry, they are known for noise generating air handlers. Simple grounding and shielding techniques go a long ways.

Date: Wed, 30 Mar 2011 21:33:26 -0700 (PDT)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] High Electrical hash noise level

You COULD eliminate the RFI, but it would take a lot of work. Put the controller board in a metal box having no large openings, complete shielding. Filter all leads into or out of the box with capacitor/inductor networks such as "brute force" PI networks. Filter components (caps) to ground get grounded to the box. Note that PWM outputs might not take kindly to high peak currents when driving directly into a grounded capacitor. In that case, the filter network as viewed from the PWM output should be an L network or an L-PI network.

If any components on the controller board generate appreciable heat, you would either provide many small ventilation openings, or a big opening or two with metal screen well bonded to the box. Alternatively, the heat-generating components might be heat-sunk to the box from the inside.

Your warranty would be null and void. Tol'ja' it'd be a lot of work.

Date: Tue, 28 Feb 2012 12:03:29 -0500
From: "Charles Gessner" <w3on@verizon.net>
Subject: [R-390] Mounting Replacement EMI Filter

I have a question. What is the best way to mount one of those replacement EMI filters for the R-390a? I purchased a Corcom 6EHQ3 emi filter some time ago, as some has suggested in the past, to replace the aging R-390a emi filter. The new Corcom unit is fairly large, as compared to the original emi filter, and does not easily fit in the cabinet. I probably could mount it on the outside rear panel, I really don't want to do that as I would like to keep the R390a as stock as possible.

Some time ago, I think about a year ago someone announced that they had worked up some sort of mounting kit to mount these type filters. Alas, no other details have emerged that I am aware of.

I have also been trying to figure out how to get the ac power to the new Corcom filter. I would prefet not to drill holes in the rear chassis. I have looked and looked for an a/c receptacle that will fit the one inch diamater hole at the rear of the R-390a. So far, I have not found any. Some have suggested using an desktop computer power supply a/c connector. I actually tried one of them, and found that they did not fit the one inch hole at the rear of the R-390a. Some have even suggested getting a computer a/c connector with the emi filter. Again, same problem. How to mount it without cutting up the cabinet.

I have read and re-read all of the emails about the emi filter. Both the pro and con about changing them or not changing them. I want to change mine.

I would appreciate any feed back about this project. I know that many of you folks reading the R-390a reflector have been through this at one time or another. I also realize that some do not want to touch this project with a ten foot pole. I also know that many of you have overcome this. I would, as I am sure others would, like to know how you accomplished this feat.

Date: Tue, 28 Feb 2012 09:47:53 -0800 (PST)
From: wli <wli98122@yahoo.com>
Subject: [R-390] re; Mounting Replacement EMI Filter

Yes, none of the available Corcoms I have seen have a round input receptacle. In my case, I merely filed a bit to get the rectangular EMI filters to fit into the round hole. No-one but me is going to see the non-stock replacement filter. In my case, the hole had to be changed to a rectangle of 2.2mm x 2.8mm.

One caveat: when you are done, be sure that the hot lead off of the EMI filter goes to the microswitch! Elementary, but all to often not checked.

Date: Tue, 28 Feb 2012 14:45:56 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Mounting Replacement EMI Filter

A few years ago, I designed some adapter plates that would accept a filter like the ones shown in the link below. The plate accepted the face of the filter and had holes that matched the original filter's mounting holes. The Corcom mounted to the plate and the plate then mounted to the inside of the rear plate on the R390A. I used one and sold most of the rest to the list members (I hope they worked out for those who bought them).

http://www.cor.com/Series/IEC/EC/

This allowed the filter to be used with no modification to the rear panel on the R390A. I think I had to trim just a very small amount of plastic away from the IEC cable to allow it to seat firmly and deeply in the Corcom but it was a negligible amount of material.

With a right-angle IEC cable, it made for a very neat connection that allowed the radio to be placed more flushly against the wall.

While I did this by designing the plate and having a local shop with a plasma cutter do most of the work, if you have access to a small milling machine, the plate would be easy to make.

Date: Tue, 15 Apr 2014 20:10:54 +1000
From: Ken Harpur <igloo99nz@yahoo.co.nz>
Subject: [R-390] Isolation Transformers, GCFI and Balanced Power

Here's something for everyone to get their teeth into...

I'm having issues with the line filters in my R-390As tripping the GCFI (doesn't everyone now?)...It doesn't happen all the time but it's a lottery every time I plug one of them in on whether it will trip or not. One filter is bad so it has been removed, awaiting a replacement. I've been all through the archives looking for ways to overcome the problem. I had intended to open them up and rebuild them with smaller value caps, then I came across a post saying that the filters could be left intact and the radios plugged into an Isolation transformer. The Isolation transformer will prevent the GCFI from tripping...

Hmm...yep seems fair enough and I have a 230 to 115V transformer here so it's do-able. I could re-wire the power supply on one radio to 115V and try it out.

So then I go away and infest google for a few hours trying to find info on

any Hams or serious SW DXers that run their boatanchor equipment through isolation transformers. Most results were referring to audio isolation to prevent ground loops but nothing on Line Isolation Transformers. All the hits that dealt with AC mains isolation transformers were for the audio guys and recording studios where they talk about Balanced Power Transformers. It seems Balanced Power is used extensively in recording studios and the concept/theory behind this is solid. We even use the same concept in radio...balanced antennas, balanced microphone and audio cables etc. I'm curious if this concept has be embraced in our radio shacks as far as cleaning up the garbage on our mains?

I can hear many different 'dirty' signals tuning around the bands on any of my R-390s...switchmode power supplys, computer screens, the TV upstairs, neighbour's washing machines etc. I had good results by moving the antenna and better quality coax. My reasoning is if the antenna can pick up these signals then the same garbage is all over our line supply as well. I realise the line filter was installed on these radios to keep signals from radiating out of the receiver via the line cord, as well as keeping common-mode interference on the line from entering the receiver...so the idea has been around a long time.

Google gave me no answers regarding Balanced Power use radio reception situations...maybe there might have been something if I read through over 1000 pages but..."Aint nobody got time for dat!"

So what do you do to mitigate noise on your line supply, if anything?

Date: Tue, 15 Apr 2014 13:14:03 -0400
From: Roy Morgan <k1lky68@gmail.com>
Subject: Re: [R-390] Isolation Transformers, GCFI and Balanced Power

> I'm having issues with the line filters in my R-390As tripping the GCFI (doesn't everyone now?)?

Those of us who live in older houses (read: not up to code for GFI outlets) don't have the problem, but some may well have the *hot chassis* problem, where about 60 volts appears from the chassis to ground, IF the chassis is not grounded. The reason is that the bypass caps in the filter are creating a voltage divider, and only SOME times because there is a leaky cap in there.

One common way to overcome the trouble is to remove the original filter, and make a plate that will hold a modern line filter nicely in the space. (Do not hope to buy a Greenlee punch that makes the hole - they are priced at over $400.00) Then use the common computer style line cords. (Are

they the same in NZ?)

> ... One filter is bad so it has been removed, awaiting a replacement.

The filters are kind of a mess, and difficult to get apart. Note that the replacement may not be better than the intermittent ones.

> ... I came across a post saying that the filters could be left intact and the radios plugged into an Isolation transformer. The Isolation transformer will prevent the GCFI from tripping?

Sounds like a fine solution. Don't forget to ground the radio well in any case. Even if there IS some safety ground wire current, I think that the GFI devices won't sense it. They sense imbalance in the line and neutral wires, and make the assumption that a person is making the connection between the line and ground (maybe some other ground such as a faucet or puddle, not necessarily the circuit safety ground wire).
>
> Hmm...yep seems fair enough and I have a 230 to 115V transformer here so it's do-able. I could re-wire the power supply on one radio to 115V and try it out.

Isn't there a switch on the power supply you move? Can't remember.

> So what do you do to mitigate noise on your line supply, if anything?

One possibility is to use a voltage regulating transformer - common name "Sola", but made also by other companies. Normally these things have an isolated secondary, though if there is a three wire grounded outlet socket, the safety ground will likely be connected through to the case and the ground on the supply cord.

Added benefits to regulator transformers may well be:
- Noise reduction. The thing may have a shield between the output winding and the input winding(s). Manufacturer's specs indicate noise isolation figures of 40 db.* If the secondary is isolated, then there is no direct connection as there is in most variable voltage transformers (Variac). Isolated variable transformers do exist, but I've never seen one.
- Over current protection. What? I won't need a fuse! It seems that the nature of the voltage regulation circuit is that with over-current of about 160 percent of rating*, the voltage collapses. There is no harm to the device, and it returns to normal once the over current is removed. So, if you have an R-390 drawing an amp (as a guess) and your "Sola" is rated at 90 VA or a bit more, you have built in protection. I have a Sola rated at 60 va, so I don?t expect that one to run an R-390. The ideal one would be the Sola 90 va or 120 VA ones.

*Sola CVS Hardwired Series
See:
<http://www.solahevidutysales.com/cvs_hardwired_series_power_conditioner.htm>

The Non-Benefits to the sola include these:
- they are somewhat heavy (65 pounds for the 1kw size)
- with little power drawn, they still make a lot of heat
- they are noisy, especially the bigger ones
- If you come across one that?s not working - it?s most likely the capacitor(s) inside, and that?s easy to replace.

One further note: The Sola brand transformers are guaranteed for 10 years. In a world full of 90 day guarantees, this means that the company thinks they almost never fail. In practical use, they really do almost never fail. So if you see one at a hamfest that looks really old and the price is modest, go for it.

An UNtested possibility: If your sola device puts out modern line voltage, it MAY be possible to add a few-turn winding onto the thing to be wired in voltage opposition to the output connection. This will make it into a line bucking voltage regulating isolation shack warming device.

Who could want more?

Date: Tue, 15 Apr 2014 16:37:29 -0400
From: "David C. Hallam" <dhallam@knology.net>
Subject: Re: [R-390] Sola Transformer

I have a 250 VA one that I have used in the past. They do run very hot and draw full load current whether or not you are using it. They definitely should be unplugged when not in use.

Date: Tue, 15 Apr 2014 16:25:20 -0400
From: Steve Hobensack <stevehobensack@hotmail.com>
Subject: [R-390] Sola Transformer

The Sola CV transformer is a good thing. They are one of a few things that can be found for a reasonable price at the E place. Not only does it isolate, they will help stability if you bypass the ballast tube with a jumper and 12ba6's. They run hot, even when unloaded. I unplug mine when the r-390a is turned off. N8YE

Date: Tue, 29 Apr 2014 20:24:02 -0400

From: Bill Cotter <n4lg@qx.net>
Subject: [R-390] Isolation Transformers for noise reduction

There is an auction for up to ten TOPAZ Ultra-Isolation Transformers part number 91091-11 (125VA 120/240V) listed at $90 (or, make offer) + $14 shipping. I just purchased one after offering $50, for a total cost of $64. The 91091-11 retailed for between $250-300 new, and is superceded by the 91091-T31 series. 321059789702

These are medical grade (shielded) isolation transformers with very good attenuation of harmonics specifications (common mode reduction = 146dB, normal mode = 65dB) above 100kHz - just right for keeping switching trash on the AC line from getting into the radio power supply.
.Specifications: http://www.pacificparts.com/vends/mge/images/t1.pdf
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Date: Thu, 01 May 2014 14:32:28 -0400
From: Larry Kirkland <lkirkland@sc.rr.com>
Subject: [R-390] R-390A FL-101 Line Filter

Just put a nice (but dead) Navy R-390A on the repair bench. I found that one leg of the powerline filter is open. I've emailed Fair Radio about a replacement. To continue troubleshooting, I am going to wire around the filter, but eventually need to replace it.

Does anyone on the list have a spare or know where I might find one?

Date: Thu, 01 May 2014 15:15:55 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R-390A FL-101 Line Filter

There was someone on the list that replaced this old filter that WILL trip a GFCI with an IEC, (Computer type) receptacle on the rear.

These are MUCH better than trying to simply replace a known issue with the same problem again.

IECs can be scavenged from any old computer power supply. The only thing to look at making sure you take with it are the X Y Safety capacitors.

Date: Thu, 1 May 2014 13:05:48 -0700 (PDT)
From: Steve Toth via R-390 <r-390@mailman.qth.net>
Subject: Re: [R-390] R-390A FL-101 Line Filter

IIRC that was Tisha, and I think Wei Li and few others have done it also.

Date: Thu, 01 May 2014 16:21:10 -0400

From: rbethman <rbethman@comcast.net>
Subject: [R-390] R 390A Line Filter Trial

This was posted by Glenn Scott WA4AOS, in Feb 2011. Folks that are looking at line filter replacement really ought to look into this. The Corcom line filter method is the one used by Tisha and Les Locklear.
Bob - NODGN

Hi Group,
I am putting a kit together to replace the old leaky Corcom line filters used in the R 390A's with new Hospital grade Corcom filters. The problem is mounting a good quality filter with better specs than the original within the existing real estate.
I came up with a solution using existing holes, a mounting plate with standoffs. This is a very tight fit but easy to install.
The filter will mount behind the PTO and is raised above the wiring harness runs in the rear. A rubber hole grommet comes with the kit to feed the line cord to the filter. The filter will additionally include 3 Varistors and a CL-80 current limiter already installed.
I was not able to find a Corcom or any other line filter solution that would mount where the original filter mounted but this solution is VERY WELL DONE and commiserate with the excellent quality within the 390A Receiver. All kits will be pre assembled, tested and burned in for at least 1 hour before shipping.

My prototype filter kits are installed in three R 390A receivers presently and the installations were perfect as well as professional looking. I am looking for 5 volunteers who have R 390A receivers to take a kit at MY COST, install them and give me feedback. Already, I know the kit fits into Motorola, Amelco and EAC R 390A's. I would like to hear from folks who have other built R 390A's for the trial. I prefer engineers, technicians or competent long term users of R 390A's for the evaluation trial period. No skills beyond operating a screwdriver are required but I am looking for professional feedback.

Of course, the usual warnings about working with any line voltages apply.You know, unplug the receiver first, capacitors hold charges, wear goggles, gloves, hazmat suites, rubber souled shoes, have 911 people online the entire time you work, seriously they love R 390A's too, and all of the usual safety stuff we all practice daily.. Oh, keep one hand in your back pocket and a carrot in your left ear too. So, if you electrocute yourself to death during installation, don't sue me because you weren't' warned. Actually, I would prefer not hearing from you if you kill yourself putting this kit in... Just saying.. .

Later, I will offer these kits to users of this reflector ONLY, at a discount

for a short period of time before I list the kits on eBay and my website. I would like the filters kits installed and reports back within a month. Please don't request a trial filter if you are NOT SERIOUS about quickly installing it and reporting your observations to me and the users of this reflector. if there are any unforeseen issues, let's find out now..

Installation is simple and should not take more than an hour; instructions will be included. You simply remove the bottom cover and the old Corcom filter. Mount the hardware to the chassis and install the filter, No soldering will be required. The kit will also include a new line cord and plug with the aforementioned mounting parts. So far, I see no reason why this kit would NOT fit into any iteration of the R 390A receiver but there are some minor variations in machining.

If all goes well, I will offer these to reflector users around the first of May. I am having the small chassis plates CNC machined this week and should have them next week. I will offer a full refund including shipping to the participants of the trial evaluation if not pleased with my kit or certainly if it will not fitsome variation of machining within the R 390A.
I plan to post some pics in the next week or two for others to view. Additionally, I will post some pics of line hash in and out of the filter.

The evaluation will help me understand any installation issues before listing these kits are offered to the general boat anchor community on eBay and elsewhere.= Please don't beat me up about changing the looks, or the filter isn't necessary, or it's not original,.or why didn't I choose a so and so filter. If you have a better mouse trap, build it. I gotta tell you, it was very time consuming to fit this or any other filter in the prototype stage. My first 5 ideas and attempts did not work out for one reason or another.

>From my perspective, the kit is 100% reversible, prevents people from getting shocked due to differences in potential between the 390A chassis and ground. I also strove for this to be a professional solution and not be a Micky Mouse, kludge attempt at fix something; I see my share of sorry mods almost every week. I treat these receivers with great respect and am trying to help with a known problem.

Thanks in advance for reading this post and your assistance to help with this project. If you think you might want a filter kit in May, please hold off letting me know until the trial is over. As with the Fowler manual copies I sold to readers of this reflector last summer, about 120 something copies all over the planet, I will make good on my offer to list these kits here at a discount for a short period of time.

If you are interested in a trial kit at my cost, will install it quickly, report your observations and are technically competent to electrically and

mechanically critique this kit please contact me at my email address listed below, Additionally, first consideration will go to owners of 390A variations other than Motorola, Amelco and EAC built 390A Receivers. Tell me which 390A you have and a little about your capabilities.

Glenn Scott WA4AOS
DSM Labs

Date: Thu, 1 May 2014 16:38:37 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] R 390A Line Filter Trial

At one time, I made several adapter plates for the CorCom filters. They were a simple piece of flat (1/8") aluminum with a correctly-shaped hole for the filter and holes for the 2 sets of mounting screws. They worked well and did not involve any permanent modifications to the radio.

I suppose if one is good enough with a just a drill and a file, a person could make one of these without too much effort. Mine were fabricated using a CNC plasma cutter that helped get all the holes in place such that the CorCom's face lined up with the existing hole (which is kind of critical since the IEC plugs are just small enough to fit inside the existing hole) but enough play in the other holes would make that possible if you're off a bit on aligning the holes.

Date: Thu, 1 May 2014 16:42:16 -0400 (EDT)
From: Glenn Scott via R-390 <r-390@mailman.qth.net>
Subject: [R-390] R390A line filter trial

I made up 45 line filter kits in late 2011 and sold them all within a few months.. I have planed to make up another set or two but been busy working through my backlog of 390 and 390A's I had metal plates CNC-ed and with the right combination of hardware, this was a 100% reversible mod, NO NEW HOLES, but I can't imagine why anyone would go back to the old leaky and open Corcom filters..If there is enough interest, I will look into assembling another batch. Installation was very tight but easily doable; looked great to boot. I know these went into Collins, Motorola, Amelco, Steward-Warner, EAC, Teledyne, Capeheart, and Imperial receivers with no clearance issues...The Amelco's were slightly tighter than the rest due to some machining variations..Never did a Fowler...Hi Hi..

Date: Thu, 01 May 2014 23:07:18 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] R 390A Line Filter Trial

Having the removable IEC cord is handy, but if that isn't an absolute

necessity the filter modules are available as "lumps" with solder terminals, much like the originals. I don't know if any currently available filters have mounting holes that exactly match the originals, but in any case some owners may find that style is much easier to mount than a complete IEC entry module.

Having said that, I have found that 390s and 390As work absolutely fine with no line filter at all. Perhaps if one is installed in a welding shop or other industrial facility with lots of immediately local noise on the power line it might help reduce the conducted RF, but in that case the radiated RF would be a much worse problem than the conducted RF anyway. So, feel free to just pull the filter out -- you won't ever notice it's gone (except that it won't trip your GFI anymore). DO retain the chassis ground wire and 3-prong plug, and DO make sure the outlet it is plugged into is properly grounded.

Date: Fri, 2 May 2014 15:32:39 -0400 (EDT)
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] R 390A Line Filter Trial

What a thought. Just run a R390 or R390A with no line filter on a GFI circuit. Heat the filter can up to melt the solder joint on the filter can.
Gut those two current passing caps out of the filter can.
Clean up the solder where you opened the filter can.
And get on with enjoying your receiver.
You need not tell anyone or take any grief over the change.

Date: Sat, 3 May 2014 13:14:09 -0400 (EDT)
From: Todd Roberts via R-390 <r-390@mailman.qth.net>
Subject: Re: [R-390] R-390A FL-101 Line Filter

One thing I did to fix the problem was to power an R-390A using an isolation transformer with at least a 250VA rating. This kept the chassis "cool" and completely eliminated any GFCI problems and negated having to change out the original line filter. I would recommend doing that for any R-390A. An easy fix.

Date: Sat, 03 May 2014 13:31:38 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R-390A FL-101 Line Filter

Personally, I like Roger's idea.
Just open up the old filter housing, gut it, and close it back up.
The last thing I need is another piece of iron on the operating position.
Between the BC-614 Speech Amp, The SP-600, and the rest of the operating gear, I really don't want it loaded any more than I already have.

Putting underneath just provides another item to break a toe on! I already have to watch my step around the two Beasts! Accidentally kicking one of them is definitely a toe breaker!

Date: Mon, 05 May 2014 10:32:58 -0400
From: Larry <lkirkland@sc.rr.com>
Subject: Re: [R-390] R-390A FL-101 Line Filter

Just an update on where I am in replacing the AC line filter on this Amelco R-390a. Lot's of good suggestions from the group. Had a couple of offers of replacements - one from a list member, and one from Fair Radio. Fair has them for $20.

However I decided to go with Bob, NODGN's suggestion of using a IEC computer type filter with the cord socket built-in. I searched my shop and found one that had a Sprague label on it. It looked in good shape, so I made a little sheet metal adapter for it because I wanted to use the receiver's original hole layout. It fit perfectly.

Now the receiver is back to life, at least on a variac. I need to check that capacitor in the IF deck that feeds the mechanical filters, but can't find my bristol wrenches. I have some ordered, so am waiting on them before I do much else. Thanks for all the good advice.

Date: Sat, 10 May 2014 13:16:27 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] R-390A FL-101 Line Filter

I have been a long-time advocate of replacing the line filter with a higher grade component. What I suggest is; Corcom 3EHQ1 or 3EHQ3 (Q1 uses lugs, Q3 uses wires).

The 3E means the ampere rating of the Corcom filter. You can also go with a 6E (6 amp) filter).

This is a hospital grade filter (letter designator H) , just about the best you can find, exceptionally low leakage current.

Here is an excerpt from the Corcom HQ Series Line Filters pdf;

The HQ series power line filters provide the highest available common-mode and differential-mode attenuation to RFI noise in the frequency range from 10kHz to 30MHz, for IEC 60601 and UL2601 patient-connected equipment, as well as all other electronic equipment that cannot tolerate any leakage current. They are a size- and more cost-effective

solution to the problem of meeting both medical leakage current limits and conducted emissions limits in equipment with high noise sources (such as switching power supplies).

The 3EHQ filter is rated for 3 A continuous, 10 A peak
The 6EHQ filter is ratd for 6 A continuous, 18 A peak

Leakage current is less than 2 uA. Waaaay below anything that will trip a GFCI.

Line to ground attenuation is between 44 and 10 dB .5 to 30 MHz
Line to line attenuation is between 75 and 60 dB, .5 to 30 MHz
---
Ask yourself this, the radio was designed in the 1950's where the biggest source of RFI was car ignition systems, maybe the occasional fluorescent light bulb. The RFI sources today are the hundreds of tiny little oscillators in every electronic device in your home, switching power supplies and poorly designed CFL's. Do you think you need more or less RFI filtering today?

You can get a Corcom 3EHQ or 6EHQ for less than $40 on eBay. It is your choice.

Date: Sat, 10 May 2014 15:18:51 -0400
From: rbethman <rbethman@comcast.net>
Subject: [R-390] FL-101 replacement Corcom IEC power Filters

Corcom also makes the IEC power line filters in the "L" model that are also hospital grade. They are far less expensive than those that Tisha proposes. There are many different ways to achieve the level of protection and meet high standards of quality and ease of installation. The IEC power line filters also allow for a very easy to obtain power cord. Some years back I obtained a box of 100 power cords that are IEC types.

Date: Sat, 10 May 2014 13:39:02 -0700
From: "Craig Heaton" <hamfish@efn.org>
Subject: Re: [R-390] R-390A FL-101 Line Filter

Not to say which is the correct choice, to filter or not to filter (FL101). Disconnect the antenna; is the receiver quiet? If the receiver is quiet with the antenna disconnected, my money is on RFI via the antenna.

Date: Sat, 10 May 2014 15:44:49 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: Re: [R-390] R-390A FL-101 Line Filter

If these filters have such high reactance (low current) to ground at 60Hz, there's not much capacitance where filters normally have capacitance.Does this explain the relatively low line to ground attenuation? Why is the line to ground attenuation less at higher frequencies?

IMHO, the original filter does not leak, it has enough capacitive reactance to ground to trip a GFCI. The problem of shocking the operator goes away if the radio is properly grounded. If it is properly grounded, there is no need for a GFCI. Does anyone know the attenuation specs for the original filter? Bill Hawkins

P.S. Actually, the filter was designed to reduce the RF produced by adjacent transmitters. That interference is way beyond today's sources. The problem with them is that they get in through the antenna. Again, IMHO. I've been wrong before, and can probably do it again.

Date: Sat, 10 May 2014 17:55:05 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] R-390A FL-101 Line Filter

While noise reduction may be a factor, I think the real reason for going to a modern filter (or no filter at all) is the fact the old filters trip GFCIs and if you're trying to power your radio from a GFCI-protected outlet, then you need to consider alternatives.

Date: Sat, 10 May 2014 17:59:14 -0400
From: rbethman <rbethman@comcast.net>
Subject: [R-390] FL-101

Roger's idea to simply open it and gut it should be more than adequate. The majority of RFI or EMI if you prefer, is going to be indeed coming in on the antenna. I find that true with my Northern Variant SP-600. I get all the hash and trash on the antenna. I've yet to eliminate that in particular. I don't have issues with the power input. I've let it sit with a scope on the power input, and don't see any trash.

Date: Sat, 10 May 2014 18:02:59 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R-390A FL-101 Line Filter

You have nailed it on the head! Roger's suggestion to open FL-101, gut it, and close it back up is enough to suffice. As I had just posted, the power input watched with an oscilloscope shows no trash at all. Not wishing to fight with GFCI issues, simply removing the innards would be fine.

Date: Mon, 12 May 2014 11:08:22 -0700

From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

Are you sure, Bob? I did find an L series at Corcom's website, but it's a "dual-configuration power entry module" that (a) doesn't look like it will fit, and (b) has no particular high-performance filtering ability.
You might as well take any random module.

Date: Mon, 12 May 2014 11:48:17 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] R-390A FL-101 Line Filter

> You can get a Corcom 3EHQ or 6EHQ for less than $40 on eBay.

Not right now. But 3EQ1 and other H-less Q series can be had for less than $20. That's still less than 0.5mA, an order of magnitude below the standard GFCI trip point. N, U, and Z series are also pretty good filters and the same price range. To figure out what will fit, you'll have to download datasheets from TE.com .

Date: Mon, 12 May 2014 14:48:56 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

I downloaded their Catalog: 1654001, Issue date 06.2011.
The title is "Highest Performance RFI Filters for Medical Equipment".
That would indeed be "Hospital Grade" the last I understood.
You have choices between IEC, lug attachment, or wires extending.
One makes the choice that they wish.
The IEC version has wires coming out to go to the load.
The module could easily be attached outside on the rear.
Personally, I'd simply take a computer IEC line filter.
If it protects a computer for hash trash and surges, it would do the same for a receiver. I see no reason in the world paying top $ for a line filter!

Date: Mon, 12 May 2014 14:53:02 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters
FURTHER

I would also add that the specs state 125VAC leakage current to ground - 2uA.
Hipot line to ground (one minute) 2250VDC
Hipot line to line (one minute) 1450VDC
That would seem to be far more than adequate!

Date: Mon, 12 May 2014 11:53:52 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

That's the HQ series - the same one that Tisha cited - not the L series.

Date: Mon, 12 May 2014 14:56:59 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

True. However the large Corcom catalog indicates L Series as being "Hospital Grade". I spent the better part of an afternoon looking this all up.

Date: Mon, 12 May 2014 12:06:55 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

Not to pick a fight, Bob, but I have that catalog open right now. Searching for "Highest Performance RFI Filters for Medical Equipment" takes me to the HQ series, page 37. Searching for "L series" takes me to page 175, "Dual Configuration Power Entry Module". There is an HL ("Medical") variant of that but it's no great shakes as a filter.

You can get a 3EQ1 or 3ET1 on eBay right now for less than $20. Myself, I'm on a non-GFCI circuit, plus my captive cord is in superb condition.

Date: Mon, 12 May 2014 15:28:28 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

Here is a link to the L-Series:

<http://www.futureelectronics.com/en/technologies/electromechanical/power-supplies/power-filters/Pages/2081859-6609123-5.aspx>

$26.12 each.

Corcom L Series Medical RFI Filtered Power Entry Module - 6EHL4

Catalog:
<http://www1.futureelectronics.com/doc/TYCO%20ELECTRONICS/6609123-5.pdf>

Date: Mon, 12 May 2014 16:18:44 -0400
From: "Don Heywood" <wc4g@knology.net>
Subject: [R-390] R-390 family AC FILTERS

Lets all play king of the mountain...My five receivers all have the original filters which work great with my bucking transformer system, all are properly grounded. No green dots.

Date: Mon, 12 May 2014 16:24:05 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R-390 family AC FILTERS

I don't have an issue one way or the other.
I simply provided information.
My downstairs Den/Shack finished basement has NO GFCI circuits except in the bathrooms. I never had a tripping issue. No funky extra transformers either. A '67 EAC ran for over four years with no issues.

Date: Mon, 12 May 2014 15:25:55 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] FL-101 replacement Corcom IEC power Filters

At one time I did compliance engineering and type acceptance testing for radio, telcomms and computing equipment. The first product I ever tested for our company completely failed in every category of Part 15 and Part 68. It was just a neat little switching power supply with a supply fuse and a power switch. Since it was post-engineering and "only" had to be modified slightly to make the FCC happy I had to resort to engineering out my own solutions.

Under Part 68 testing we also had to comply with the rather stringent requirements of not splattering noise back across the telephone network. They referred to noise as longitudinal or metallic noise. Some of it had to do with the ideal balanced circuit of the telephone audio pair.

Part 15 had more to do with how much noise our little switching power supply and oscillators were spewing out into the general environment through the line cord or radiated from the case.

Parts of this testing were done in a giant wooden barn way out in the country with no nearby transmitters. They had a reference antenna attached to an arm that could sweep from vertical to horizontal, while also rotating the antenna to change polarization and the DUT (device under test) was mounted on a giant wooden turnstile that was rotated with ropes and pulleys. It took all day, just for us to go through the testing with the spectrum analyzer to find every form of emission coming out of our little modem/data transfer switch. We failed the test several times and it was back to the drawing board to figure out what was next to isolate the source of interference that we were generating. Needless to say it was a painful

but long remembered exercise in product design.

I learned to get the best line filter possible for the device. Yes, I engineered a few of my own but in almost every case it was cheaper and easier to go with a Corcom (on our stuff, with the IEC plug) to clean up what trash that switching power supply was putting out there. Sometimes it was as simple as changing how the wires were routed in the device, how big the ground plane there was on the circuit board, was there a star washer on the ground wire to the chassis...

I also learned that the entire idea of "type acceptance based upon similar products" is a complete load of B.S. That is the current FCC approach; "if something has four legs and eats grass it must be a horse". So if you test one horse you have tested them all. The reality is far different, even innocuous changes in a device can have profound impacts upon what it does to the EMI/RFI environment.

Our receivers are less critical but even in the 1960's someone recognized that due to a minor flaw in manufacturing the radio made measurable noise from the IF. Hence they added a mod to put finger-stock in certain parts of the chassis. I guess they did not want an aircraft carrier catching a nuclear version of a H.A.R.M. missile because some radio op was catching the west coast show of Johnny Dollar on one of the spare '390's.

As had been mentioned, the radio has plenty of places where stray RF is going to get inside of the radio. Much of this can be cured if owners would put the utah plate back on, the top and bottom covers and the tube shields. We know the caps in the line filters are getting leaky and now are tripping GFCI outlets or putting a pleasant AC voltage on the chassis. Rather than just bypassing the filter module I prefer to put a $40 filter on my $800 radio.

Date: Mon, 12 May 2014 14:22:28 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

Yes, that's what I saw for L Series. Not "highest performance" as a filter. Might as well pick any random power entry module. If you want actual filtering, you'll have to go with Q, T, et al.

By the way, if anyone wants to download that Corcom catalog, beware that some jiggery-pokery may be necessary. ____
TE's website is a bit odd.
E's website is a bit odd.
-

Date: Mon, 12 May 2014 17:32:54 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

The finger stock is present in my Collins '54 contract R-390A.
Date: Mon, 12 May 2014 17:32:54 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

The finger stock is present in my Collins '54 contract R-390A.____
It is in bad shape, as it is/was a Blue-Striper. The finger stock is
It is in bad shape, as it is/was a Blue-Striper. The finger stock is ____
very corroded. These strips are present in the old chassis. I wonder if it was added
very corroded. These strips are present in the old chassis. I wonder if it was added ____
at some later time. Hence I obtained an empty chassis to put the modules in.
-

Date: Mon, 12 May 2014 17:49:31 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

I'd say that the EHL leakage as 2uA line to ground is pretty darn good for leakage. We aren't getting into line to 50 ohm issues for insertions losses.
-

Date: Mon, 12 May 2014 19:46:58 -0700 (PDT)
From: Perry Sandeen via R-390 <r-390@mailman.qth.net>
Subject: [R-390] More AC Filter FFT

____
I apologize in advance for this long post.
I apologize in advance for this long post.

____
<Wrote: IMHO, the original filter does not
leak, it has enough capacitive reactance to ground to trip a GFCI.

True

<Wrote: The problem of shocking the operator goes away if the radio is properly grounded. If it is properly grounded, there is no need for a GFCI.

Not quite.? Stuff happens. I spent the last 25 years of my working years as a Bio-medical Electronics Technician and am certified as such. Electrical

safety was the top of our list. Let me explain a bit. The heart is most sensitive to having its signals disrupted at 59 Hz.
<Wrote: IMHO, the original filter does not
leak, it has enough capacitive reactance to ground to trip a GFCI.

True

<Wrote: The problem of shocking the operator goes away if the radio is properly grounded. If it is properly grounded, there is no need for a GFCI.

Not quite.? Stuff happens. I spent the last 25 years of my working years as a Bio-medical Electronics Technician and am certified as such. Electrical safety was the top of our list. Let me explain a bit. The heart is most sensitive to having its signals disrupted at 59 Hz.____
Above and below that frequency, it is far less sensitive to disruption. The following is____
simplified a bit but is accurate. The lowest amount of current that they found that
would upset the hearts electrical signals was around 200 micro-amps applied directly to the heart.____
simplified a bit but is accurate. The lowest amount of current that they found that
would upset the hearts electrical signals was around 200 micro-amps applied directly to the heart. ____
This led to the following requirements:
____
Ground cord resistance to chassis had to be less ____
than 500 milli-ohms.
Maximum ungrounded leakage with both normal and____
han 500 milli-ohms.
Maximum ungrounded leakage with both normal and ____
reversed polarities of the AC line to the instrument had to be less than 50‰____
micro-amps.____
micro-amps. ____
Most electrical instruments used had a leakage in the 100 to 200 micro-amp range and a ground cord to chassis resistance around 100 milliohms.____
ost electrical instruments used had a leakage in the 100 to 200 micro-amp range and a ground cord to chassis resistance around 100 milliohms. ____
Electrode leakage current (patient monitors) had____
lectrode leakage current (patient monitors) had ____
to be less than 10 micro-amps with 110 VAC applied. These requirements basically meant that if you even had a two fault failure, the patientÕs heart would not go int____
o be less than 10 micro-amps with 110 VAC applied. These requirements

basically meant that if you even had a two fault failure, the patientÕs heart would not go into____
fibrillation. That is a condition where____
fibrillation. That is a condition where ____
the heart beats out of synchronization and blood is not pumped to the body.____
This will spoil your day permanently after 5 minutes. ____
With the normal ungrounded leakage out of the____
ith the normal ungrounded leakage out of the ____
This will spoil your day permanently after 5 minutes._____original filter, and one moist hand on the chassis and the other moist hand o____
riginal filter, and one moist hand on the chassis and the other moist hand on____
a good ground, the 5 milli-amp leakage is enough to kill you by putting you____
a good ground, the 5 milli-amp leakage is enough to kill you by putting your____
heart into fibrillation.____
That is why____
GFCIÕs have a max tripping current of 5 milli-amps. Now Bubba Perrier and others have been *bit* by a hot *A* or SP 600 chassis.? And probably____
GFCIÕs have a max tripping current of 5 milli-amps. Now Bubba Perrier and others have been *bit* by a hot *A* or SP 600 chassis.? And probably ____
more times that we want to admit. ____
Usually we get an *OWIE* followed by words not heard in church. Especially if we then drop it on our body parts. The difference between an *OWIE* and getting killed depends basically on two ____
conditions.____
One is the skin moisture. The ____
second is the entrance and the exit point of the body.____
The shortest path is hand to hand as it ____
provides the closest path of least resistance to the heart. Now I have seen and have bought, numerous receivers where users solved this problem by adding a there wire cord grounde____
rovides the closest path of least resistance to the heart. Now I have seen and have bought, numerous receivers where users solved this problem by adding a there wire cord grounded____
to the chassis. It is quick and El Cheepo. At the time it was being implemente____
to the chassis. It is quick and El Cheepo. At the time it was being implemented____
there wasnÕt the availability of line filters we have now. It took the PC market and the noise from switching

regulators to spur the market to what we have today. ____
there wasnÕt the availability of line filters we have now. It took the PC market and the noise from switching
regulators to spur the market to what we have today. ____
Yes it works well until there is a defect in the ground wire or the GFCI issue arises.____
es it works well until there is a defect in the ground wire or the GFCI issue arises. ____
Now the correct solution these days is to replace the original with a low leakage computer type of filter.____
ow the correct solution these days is to replace the original with a low leakage computer type of filter. ____
With a little notching in four places in the original round mounting circle, the Corcom 3EEA1 filter is an EXACT match for the screws of the original filter. It i____
ith a little notching in four places in the original round mounting circle, the Corcom 3EEA1 filter is an EXACT match for the screws of the original filter. It is____
safe and usually costs less than five dollars. When you replace the filter there is another____
safe and usually costs less than five dollars. When you replace the filter there is another ____
issue. In the original wiring configuration, one input wire went to the power switch and the other to th____
ssue. In the original wiring configuration, one input wire went to the power switch and the other to the____
input fuse.____
It is simple to reconfigure the ____
as there is plenty of room due to the new filter being smaller.____
That leaves plenty of room to add a MOV to the incoming line and replace the bathtub C103, 50uF/50 volt, with a new____
electrolytic as this is a filter capacitor for the RF gain control.

At one time we thought those bright nickel-plated____
electrolytic as this is a filter capacitor for the RF gain control.

At one time we thought those bright nickel-plated ____
tube shields were the best things for tubes. Then the IREC black aluminum bodied tube shields with beryllium copper heat wicks were introduced and w____
ube shields were the best things for tubes. Then the IREC black aluminum bodied tube shields with beryllium copper heat wicks were introduced and we____
found that they were far superior to what we had before and we changed over to them.

In the same manner new line filters have been____
found that they were far superior to what we had before and we changed over to them.

In the same manner new line filters have been ____
manufactured that have better RF suppression characteristics and solved th____
anufactured that have better RF suppression characteristics and solved the____
high leakage/GFCI tripping problems of the original AC input filter ande ar____
high leakage/GFCI tripping problems of the original AC input filter ande are____
easily retrofitted to our receivers. So for me it is a better part replacement, not a modification.____
easily retrofitted to our receivers. So for me it is a better part replacement, not a modification. ____
Avoiding the chance of an *OWIE* or worse is my
motivation for putting them in my receivers. As Tisha pointed out it is our choice to make.
voiding the chance of an *OWIE* or worse is my
motivation for putting them in my receivers. As Tisha pointed out it is our choice to make.
-

Date: Mon, 12 May 2014 23:24:28 -0400
From: <Jbrannig@verizon.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters
FURTHER

Or how my '67 EAC ate my printer.... ____
/ecades ago the AEA PK-232 offered a FAX capability. A special cable connected the PK-232 to a dot-matrix printer, an RS-232 cable to the computer (DOS) and an audio cable from a receiver. My new R-390A was perfect for this task. It sat on one frequency all day
Decades ago the AEA PK-232 offered a FAX capability. A special cable connected the PK-232 to a dot-matrix printer, an RS-232 cable to the computer (DOS) and an audio cable from a receiver. My new R-390A was perfect for this task. It sat on one frequency all day ____
and AP wirephotos would slowly appear on the dot-matrix printer... ____
really neat... At some point my printer died....after trying everything, I took it to a local "printer repair" place. The tech told me "the electronics were fried" At some point in all this troubleshooting I discovered that the 390 chassi____
eally neat... At some point my printer died....after trying everything, I took it to a local "printer repair" place. The tech told me "the electronics were

fried" At some point in all this troubleshooting I discovered that the 390 chassis____
was "hot" with AC and that probably fried my printer. The receiver has been properly grounded since that time and there have bee____
was "hot" with AC and that probably fried my printer. The receiver has been properly grounded since that time and there have been____
no more "issues"
no more "issues"
-

Date: Mon, 12 May 2014 23:07:20 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

There seems to be some confusion about the meaning of leakage.

Capacitors are said to be leaky when their insulation resistance has decayed with time, and we are dealing with long times in these old radios. GFCI's are tripped by about 5 MA of "leakage" current from the radio to ground, regardless of its source or phase angle to the line.

A capacitor of 0.1 mfd with very high insulation resistance has an impedance of about 27 K ohms at 60 Hz, from Z = 1/(2Pi*f*C) (C in farads). Line voltage of 120 volts produces a current of about 4 milliamps, and two of them produce 8 MA, enough to trip a GFCI.

So when someone says a filter is leaky, they are not talking about the ____ leakage that comes with age, yes? They are talking about the reactive leakage current that occurs with capacitive reactance at line voltage and frequency, no?

In other words, a brand new R-390 class filter will trip a GFCI even if____
eakage that comes with age, yes? They are talking about the reactive leakage current that occurs with capacitive reactance at line voltage and frequency, no?

In other words, a brand new R-390 class filter will trip a GFCI even if ____ it shows infinite DC leakage resistance.____
t shows infinite DC leakage resistance. ____
In other, other words, a filter that does not trip a GFCI has to be less effective than the original because it has less capacitance to ground. And it is that capacitive reactance at RF that makes the filter work, with the aid of some series inductance.

Does that clarify leakage?

Bill Hawkins

P.S. Earlier, I failed to mention that a significant amount of line____
n other, other words, a filter that does not trip a GFCI has to be less effective than the original because it has less capacitance to ground. And it is that capacitive reactance at RF that makes the filter work, with the aid of some series inductance.

Does that clarify leakage?

Bill Hawkins

P.S. Earlier, I failed to mention that a significant amount of line ____
noise was produced by the generators at field locations. That would account for the large capacitors in the filter. Switching supply frequencies are much higher than 60 Hz, allowing smaller caps to be used in filters for today's conditions. Collins actually tried a switching supply (with thyratrons) to allow the radio to use 115 VDC as a supply. This supply replaced the 60 Hz power transformer inside the radio. It was abandoned, along with an internal dynamotor, because there was too much electrical noise to meet the sensitivity specs. See the Engineering Report.

Date: Tue, 13 May 2014 02:22:30 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

>So when someone says a filter is leaky, they are not talking about the
>leakage that comes with age, yes?

Date: Tue, 13 May 2014 02:22:30 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

>So when someone says a filter is leaky, they are not talking about the
>leakage that comes with age, yes?____
>They are talking about the reactive leakage current that occurs with
>capacitive reactance at line voltage and frequency, no?

Correct, generally speaking, although it would not be unthinkable to

>They are talking about the reactive leakage current that occurs with
>capacitive reactance at line voltage and frequency, no?

Correct, generally speaking, although it would not be unthinkable to ____
find one with excessive ohmic leakage at this age. That said, I have

find one with excessive ohmic leakage at this age. That said, I have ____
yet to see one with ohmic leakage.

>In other words, a brand new R-390 class filter will trip a GFCI even if
>it shows infinite DC leakage resistance.

Correct, if the GFCI is operating properly.

>In other, other words, a filter that does not trip a GFCI has to be less
>effective than the original because it has less capacitance to ground.
>And it is that capacitive reactance at RF that makes the filter work,
>with the aid of some series inductance.

It's more complicated than that. Modern line filters use
yet to see one with ohmic leakage.

>In other words, a brand new R-390 class filter will trip a GFCI even if
>it shows infinite DC leakage resistance.

Correct, if the GFCI is operating properly.

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>effective than the original because it has less capacitance to ground.
>And it is that capacitive reactance at RF that makes the filter work,
>with the aid of some series inductance.

It's more complicated than that. Modern line filters use ____
"common-mode chokes" -- two equal windings on the same core, each
"common-mode chokes" -- two equal windings on the same core, each ____
placed in series with one leg of the supply, in phase
placed in series with one leg of the supply, in phase ____
opposition. So, differential mode current flows unimpeded, but
opposition. So, differential mode current flows unimpeded, but ____
common-mode current is opposed by the choke's magnetic
common-mode current is opposed by the choke's magnetic ____
field. Theoretically, this eliminates the need for capacitors to
chassis (or at least makes smaller caps do a bigger job than they
field. Theoretically, this eliminates the need for capacitors to
chassis (or at least makes smaller caps do a bigger job than they ____
would otherwise do). Indeed, that is precisely how "medical grade"
would otherwise do). Indeed, that is precisely how "medical grade" ____
line filters operate -- they rely solely on the common-mode chokes to
line filters operate -- they rely solely on the common-mode chokes to ____
suppress common-mode currents, without the benefit of any capacitors
suppress common-mode currents, without the benefit of any capacitors
____
to chassis.

Using two common-mode chokes in series makes the medical-grade
to chassis.

Using two common-mode chokes in series makes the medical-grade ____
filters somewhat effective, but the best hospital-grade filters do
filters somewhat effective, but the best hospital-grade filters do ____
not have nearly as much common-mode attenuation as comparable filters
not have nearly as much common-mode attenuation as comparable filters
____
that have two chokes and DO have capacitors to chassis. Why is
that have two chokes and DO have capacitors to chassis. Why is ____
this? Common-mode chokes work because any common-mode voltage
this? Common-mode chokes work because any common-mode voltage ____
creates equal currents of opposite phase, which oppose and cancel
creates equal currents of opposite phase, which oppose and cancel ____
each other. Therefore, they are very sensitive to any imbalance in
each other. Therefore, they are very sensitive to any imbalance in ____
the magnitude or phase of the currents generated in the common-mode
the magnitude or phase of the currents generated in the common-mode
____
choke. As anyone who has tried to make a wideband RF transformer or
choke. As anyone who has tried to make a wideband RF transformer or
____
balun can attest, getting good magnitude and phase matching over a
balun can attest, getting good magnitude and phase matching over a ____
wide frequency range is difficult. The capacitors to chassis make up
wide frequency range is difficult. The capacitors to chassis make up ____
for the limited performance of common-mode chokes by themselves.

Consequently, "medical-grade" line filters are substantially inferior
for the limited performance of common-mode chokes by themselves.

Consequently, "medical-grade" line filters are substantially inferior ____
to standard line filters in all respects except leakage current,
to standard line filters in all respects except leakage current, ____
which you can easily see if you look at the attenuation __
vs. frequency ____
data. For example, compare the attenuation of a 3 amp Corcom
data. For example, compare the attenuation of a 3 amp Corcom ____
medical-grade filter (3EHQ) to the Corcom 3VAQ (or even the 3EP or
3EMC).

Since standard filters have leakage currents well below 1mA, there is
medical-grade filter (3EHQ) to the Corcom 3VAQ (or even the 3EP or
3EMC).

Since standard filters have leakage currents well below 1mA, there is ____
absolutely no need for medical grade line filters in the radio room
absolutely no need for medical grade line filters in the radio room ____
and they are clearly not recommended. Luckily, line filters do not
and they are clearly not recommended. Luckily, line filters do not ____
do anything useful for the way we operate radios, so they are really
nothing but decoration in any case and there is no penalty for using
do anything useful for the way we operate radios, so they are really
nothing but decoration in any case and there is no penalty for using ____
one that doesn't work very well. Indeed, as I suggested the other
one that doesn't work very well. Indeed, as I suggested the other ___
day, you can remove it entirely and you will never notice that it is
day, you can remove it entirely and you will never notice that it is ____
gone (except that it won't trip a GFCI).
gone (except that it won't trip a GFCI).

Date: Tue, 13 May 2014 06:55:34 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters
Content-Type: text/plain; charset=UTF-8

I have given y'all my best advice. I am signing off of this conversation.
Date: Tue, 13 May 2014 06:55:34 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters
Content-Type: text/plain; charset=UTF-8

I have given y'all my best advice. I am signing off of this conversation.____
Do what thou will.
Do what thou will.

Date: Tue, 13 May 2014 13:02:55 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

Well, please don't give up on us. Your contributions have above average value. As in any group, we have different viewpoints. A famous example from India is the blind men examining an elephant. Each forms a different model of the elephant depending on which part of it they touch. The only way they can understand the whole elephant is to share their findings. We have all learned more about line filters from this conversation.

Date: Tue, 13 May 2014 14:15:05 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

I think Tisha is simply declaring the horse as officially dead...

Date: Fri, 16 May 2014 17:55:24 -0400
From: Mike Carroll <mike@lacperdu.com>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

I agree that this topic has been adequately addressed (beaten to death) but I'm in need of an education re: the alternate; isolation transformers. If getting zapped is the result of a fault within the device, what does an iso transformer do to address that issue? I'm assuming that the transformer is installed at the mains, i.e., before the plug.

Date: Fri, 16 May 2014 17:33:45 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

An isolation transformer isolates any stray current (except to the primary (which does not happen in a good isolation transformer)) that may trickle out of the R-390, so that the GFCI will not trip (unless the transformer is bad).

Indeed, as long as no wire from the transformer secondary is grounded, you cannot get a shock from the R-390 to Earth ground that is due to the isolated power circuit. You can still learn a nasty lesson from B+ to chassis ground, however.

It is still a good idea to ground the frame of the R-390 to Earth so the antenna current can go somewhere, unless you are using a balanced antenna. Hope there's enough disclaimers in there.

Date: Sat, 17 May 2014 09:10:58 +1000
From: Pete Williams <jupete@internode.on.net>
Subject: [R-390] RE KNOB repair

G'day all.....Since I have had the modification done to 5 or 6 knobs over the past 5 years. there has been no severance of the insert from the knob.... the only one that is subject to stress is the MHz control but it's not being asked that much to provide traction , If the change mechanism is that tight to wrench it apart it needs fixing. Any knowledgeable machinist will be familiar with the setting/fixing glue which I suggest has better holding power than the bog/diecast metal the knobs are made from anyway.

Date: Fri, 16 May 2014 19:19:10 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] Isolation transformers [WAS: Corcom...]

>ground the frame of the R-390 to Earth.....<snip>

Not just for the antenna, but for electrical safety as well. An isolation transformer should have a "pass-through" ground -- the third prong should be continuous from the radio to your house ground, but NO PART OF THE ISOLATION TRANSFORMER should be connected to it (except the neutral wire to the primary, but that is done at your service entrance, not inside the isolation transformer cabinet -- see below).

That is the difference between using an isolation transformer and not using one. One side of a US 120v mains supply (the neutral) is connected to your house ground at or near the service entrance, so there is a current path from the grounded radio chassis to your house ground. If all is well, no current flows in this path because the voltage at both ends is the same or very, very close to it. But if something goes wrong, current CAN flow in this path. Since there is no such path from the secondary side of a properly wired isolation transformer, no current can flow in it even if something does go wrong.

So -- what is the safety reason for the pass-through ground? Because you might knock over a lamp, break the bulb, and have the hot wire touch the radio chassis. Or, possibly more likely for a ham or SWL, a falling tree could take out your antenna and a power line, and connect them to each other. Or your antenna could be hit by lightning. If the radio chassis is grounded, you are protected (to the same extent fuses and GFIs protect you in normal circumstances). If the radio chassis was not grounded, that current could flow through you and add "SK" to your call sign.

Date: Fri, 16 May 2014 20:59:30 -0400 (EDT)
From: Todd Roberts via R-390 <r-390@mailman.qth.net>
Subject: Re: [R-390] FL-101 replacement Corcom IEC power Filters

If you would like to keep the receiver in original condition and not have to gut the line filter and the original input line filter is not damaged, then using an isolation transformer is a good solution to prevent tripping an outlet that has a GFCI. An isolation transformer provides balanced and isolated power to the receiver so that the chassis will not be "hot" or unbalanced in relation to ground even with the normal leakage in the filter. I have found in many cases using an isolation transformer will greatly reduce line noise from getting into the receiver also.

Date: Sat, 25 Mar 2017 23:03:16 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] AC line input filters

I need to by 10 ac input line filters for some receivers.

Here be the problem:
New Corcom from Mouser $7.47 each when buying 10.
New China equivalents are about $3 each.
If I was buying just one or two, I'd go with Mouser.....
Since all the computer PS come with the China versions, their selling a lot in China. So the question is of quality and comparable RFI/EMI suppression.

Date: Mon, 27 Mar 2017 15:16:49 -0400
From: Roy Morgan <k1lky68@gmail.com>
Subject: Re: [R-390] AC line input filters

I suggest you research the surplus parts sellers. (We still have some, don't we?) . Some place must have a bin full of those things. They also show up at hamfests. Of course they come in a variety of forms: connector less (solder terminals only), right angle, high current, normal current, and so on.
I think the latest quoted price of the Greenlee punch that is just right was a bit over $400 each.

Date: Thu, 6 Apr 2017 07:08:24 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] AC input filter update

A while back I posted a question about AC input EMI filters and the cost of ones from China. I got a reply mentioning that maybe the first batch were OK but not the latter. In my search I looked into the JAMECO catalog. They sell what they call "an AC input filter" that is low cost BUT it isn't the same as a true EMI filter. My solution is just buy from Mouser and avoid what can be found on EBay, including "refurbished". How one can "refurbish" a sealed filter is beyond me.

Date: Thu, 6 Apr 2017 13:45:06 -0400
From: Roy Morgan <k1lky68@gmail.com>
Subject: Re: [R-390] AC input filter update

I would not trust any EMI filter from China. Especially if it is claimed to be "reconditioned". You rare right in asking what can be rebuilt in a sealed filter. Maybe they are removed from working equipment, and the solder contacts are cleaned of old leads and solder!

Date: Thu, 6 Apr 2017 12:54:15 -0500
From: Robert Nickels <ranickel@comcast.net>
Subject: Re: [R-390] AC input filter update

I've used lots of these Chinese-made IEC noise filters from MPJA, they

work as they should and are listed by international approval agencies:

http://www.mpja.com/Noise-Filter-AC-Line-10A-250VAC-IEC-Input/productinfo/31918+FL

Other types are available as well - a good supplier for all things power-related.

Date: Fri, 14 Apr 2017 14:36:45 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Just Right AC input filters

Those look about like the ones I used. Funny how the seller charges $0.25/piece shipping for each additional item when he's using a USPS Flat Rate box. Maybe 15 wouldn't fit in one box(?) but several of them would.

Date: Fri, 14 Apr 2017 21:30:03 +0000
From: Les Locklear <leslocklear@hotmail.com>
Subject: Re: [R-390] Just Right AC input filters

I've had that one in my John R. Leary Re-Engineered SP-600 for years, works as it should.

Date: Tue, 18 Apr 2017 23:45:54 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Corcom 3ED1 filter

Good news my fellow Heretics!
The Corcom filter screw mounting holes are an an exact match for the OEM filter. Now it's true (close your eyes purists) that you will have to cut the OEM round hole to a rectangle to inset the filter. but the filter covers the top and bottom of the hole so it's hardly noticeable.?
Now you have the chance to repair on OEM wiring configuration that does not meet current (pun intended) standards. The "Hot" wire should be attached to the on-off switch.through the fuse. AFAIK both the "A" and our sister receiver, the SP 600 originally had the fuse on one side of the input and the switch on the other. There are several benefits to do this upgrade. First if you lose your dedicated green ground, you won't get nasty tingle, or worse, if you'd touched the chassis and a true ground. Next, the filter allows you to use a standard computer cable instead of the usually found funky power cord connections. One gains space to be able to replace that bathtub electrolytic used on the RF gain control. It most likely has high leakage being around 50 years old. Additionally there is now space to install a CL 90 thermistor for a slow warm-up and will have open space so it does't cook anything when it heats up. Now if it does't bother your conscience, you can sell it on ebay for more than you paid for the Corcom,

(Not recommended)

Date: Tue, 18 Apr 2017 21:21:41 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Corcom 3ED1 filter

... or you could make an adapter plate with no cutting on the back required.

Date: Sat, 11 Nov 2017 11:34:18 -0600
From: Stan Gammons <s_gammons@charter.net>
Subject: [R-390] Hot Chassis

After swapping all of the paper caps, the plug in electrolytics, replacing a couple of tubes in the audio deck which were causing an odd motorboating in the audio, replacing the RF deck and performing the alignment; I have a pretty decent performing R-390A now. There aren't a large number of out of tolerance carbon comp resistors in the radio, but at some point I plan to go back and replace them one deck at a time until all have been swapped. But, I don't really like being shocked and was wondering what is the preferred method to get rid of the hot chassis? Simply install a 3 wire power cord? Seems like I read there's still enough leakage current to trip the GFCI breakers, so maybe that's not the best way to go about it.

Date: Sat, 11 Nov 2017 12:37:53 -0500 (EST)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Hot Chassis

The power inlet filter leaks enough to give a decent current flow to the chassis. A lot of folks ditch that in lieu of a modern power filter.

Date: Sat, 11 Nov 2017 14:23:43 -0600
From: Stan Gammons <s_gammons@charter.net>
Subject: Re: [R-390] Hot Chassis

Ok. I do that then.

Date: Sat, 18 Nov 2017 20:00:43 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Hot Chassis

In most cases a hot chassis is caused by one or both of the capacitors that are built in to the AC line filter are leaking voltage to the chassis, giving it an AC potential.

There is no way to fix the filter, it is best to replace it. If you go that far you can find one that has up to 80 dB of attenuation to >300 KHz (up in

to the hundreds of MHz) RFI.

I went with a hospital-grade Corcom filter that is rated for six amps. Hospital grade devices need to have an incredibly low leakage current rating as they are often attached to patients. When I properly secured all of the chassis covers, used shielded and balanced wiring (speakers, antennas) and mounted the radio in an enclosure it barely noticed the computers in the same room.

Date: Sat, 10 Mar 2018 11:34:01 +1000
From: Pete Williams <jupete@internode.on.net>
Subject: [R-390] HOW to .....?

G'day list.... There is a reference somewhere as to method /details of opening and restuffing the electrolytics in the R-390A power supply.
Would someone give me the reference for this activity please?

Date: Fri, 9 Mar 2018 20:45:14 -0500
From: Al Parker <anchor@ec.rr.com>
Subject: Re: [R-390] HOW to .....?

I have some info and pix on how I've done it for several different caps on one of my webpages. Don't picture the R-390A ones there I don't think, but I've done them similarly. <http://www.boatanchors.org/filtercap.htm>

Date: Fri, 09 Mar 2018 21:22:17 -0500
From: jbrannig <jbrannig@verizon.net>
Subject: Re: [R-390] HOW to .....?

The R-390A cap was a bit more complicated. The base pins are aluminum and can't be soldered.I drilled and tapped the pins to accept brass screws and soldered the capacitor leads to the screwsI don't remember where I saw this. A pipe cutter opened the cans and Epoxy closed. If there is room under the chassis, just solder the caps to the bottom of the sockets. It is a lot easier

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Date: Fri, 9 Mar 2018 19:09:08 -0800
From: Fernando <n2fq@sbcglobal.net>
Subject: Re: [R-390] HOW to .....?

I just did a set and agree, the pins on mine are steel and the leads from the capacitor foils are crimped on. Not enough material to make threads on what was left over. Used so much heat on the pins that the bakelite was sizzling. Had to order octal plugs and used capacitors with axial leads.
If I were to do it again, I would cut up from the seam up a tad in the hope

the foil leads stay in tack and work with that. Or as suggested, wire them from the bottom, not on the same pins as the old caps. Just a beginners experience for what its worth

Still looking for RF and AF gain controls though.

Date: Sat, 10 Mar 2018 08:31:28 -0500
From: Bob kb8tq <kb8tq@n1k.org>
Subject: Re: [R-390] HOW to .....?

I found some cans with octal bases on them. Dropped the caps into the cans. Everything fit fine. I put the old caps in a box for a future project. In 15 years, I've never gotten back to that project.

-----Date: Tue, 16 Jul 2019 23:57:49 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] R390A OEM Line filter replacement

The R390A OEM line filter is a dangerous and problematic because of its high undergrounded leakage.

I'm posting a tutorial on the R390AFAQ site. Basically it shows one how to take out the OEM filter and replace it with the type you see on computers and newer test equipment. it's an easy fit as the new style filter fits on the original mounting screws. Also there are some notes on rewiring the the AC input to meet the current electrical safety codes.
The problem stems from the old time practice that seems to be used on all the B/A receivers thatI've come across, both military commercial.
What was done in the past was to put the fuse in one AC input lead and have the on-off switch wired in the other input lead. This can lead to a situation where the receiver is turned *off* and the fuse removed but there is AC voltage in wiring that can be touched while one has there fingers inside the receiver.? From experience I can tell you that this is not fun.
When rewired in series, if the AC input fuse is removed, there is no danger of shock IF the AC input fuse holder wires are properly insulated. Silicon rubber is dandy for this. As a bonus, with the new filter installed, there is plenty of space for series wired CL-90 surge limiter and a parallel MOV.

Date: Tue, 16 Jul 2019 20:33:37 -0400
From: jbrannig <jbrannig@verizon.net>
Subject: Re: [R-390] R390A OEM Line filter replacement

Many years ago I had my R390a hooked up to a PK-232 for fax and RTTY. I connected a dot matrix printer to the 232 for facsimile printing. POOF!.. the printer is dead.... lotsa head scratching..... Finally realized the earth ground became disconnected with all the rewiring. The hot chassis of the 390, thru the 232, killed the printer circuit board..... Got a new printer and

printed a lot of AP wirephotos and WEFAX..... (And made sure the 390 stayed grounded) Jim
---
Date: Wed, 17 Jul 2019 01:00:13 +0000 (UTC)
From: Gary Geissinger <geissingergary@yahoo.com>
Subject: Re: [R-390] R390A OEM Line filter replacement

I burnt out an IM-6402 UART the same way with a Teletype.

Date: Wed, 17 Jul 2019 04:44:50 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: Re: [R-390] R390A OEM Line filter replacement

You're a living testimonial for making the change.

Date: Wed, 17 Jul 2019 22:10:13 -0400
From: dog <agfa@hughes.net>
Subject: Re: [R-390] R390A OEM Line filter replacement

So I look at the FAQ page and can't find it, or is this something that's coming/ I was fixing my 2nd 390A today and the power cord was so old the inner insulation was so brittle it just fell apart. So I was interested in this article. I ended up just putting a new cord on the old #6 studs. At least the 2nd RX turns on and I hear noise from the headphone jack,
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Date: Fri, 19 Jul 2019 14:32:45 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] R390A Line filter tutorial - Update

I was premature on my announcing the tutorial for the line filter but it is now posted on the R390AAQ site. Enjoy. An additional note. I've installed these on SP 600's on the right hand side when facing the rear as there is more space for the installation. It is a bit more difficult as the chassis is steel but with a drill and some filing it is reasonably doable. You really do want to do this if you have an nu-modified SP-600 or HQ 180 (which came from the factory with a two wire cord) as both use .01 mF ceramic caps on both sided of the AC line to the chassis. And yes in the far distant past I got *bit* when two wire cords were the norm. I was in a dampish basement. Not fun. The same AC wiring applies to both as well.

Date: Wed, 24 Jul 2019 05:16:06 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Two new tutorials posted on the R390A FAQ site

Al has posted two new tutorials I've written. The first is how to replace the OEM large and dangerous AC input filter, FL101 with a modern computer

input style filter.? They are smaller and work better than the OEM and best of all won't shock the dickens out of you if there is no 3 wire ground ans you are grounded when touching it.

The second is an electronic regulated PS circuit. Now why would you really want to use it. I'm so glad you asked. Besides good B+ regulation there is IMNSHO a much more important feature. Almost all have given up 26Z5's because of cost and use SS diodes.? And here lies the problem.? When first turned on before the filaments have a chance to warm, up full B+ is applied to the tubes and filter capacitors. Both aren't happy with this. This causes tubes to be stressed and causes premature failure.
Now they're not making the tubes we use anymore and the prices are slowly rising so prolonging their life has direct economic benefits for us.

This wasn't a problem with filament rectifiers as B+ would slowly rise as the tube warmed up.

So the circuit I came up with has a RC delay for a slow B+ rise.
An additional benefit that is new to this is the LR8 three terminal programmable HV IC. With just two resistors it can be set from 12 to 450V.? This can be used on any B/A receiver.? Used alone it can replace a 0A2 or any other gas regulator. What is so very helpful is that one doesn't need an input dropping resistor. All the details are on the tutorial.

Date: Wed, 24 Jul 2019 22:08:00 +0300
From: alex kosman <alexkosman10@gmail.com>
Subject: Re: [R-390] Two new tutorials posted on the R390A FAQ site

Hello, I absolutely agree, those old input AC filter make the "differential relay" mounted in many modern houses to turn off the electric supply. If someone wants to open the old filter and replace the caps it will work, but its not electronics but archeology !! And, applying HV to cold tubes is a bad idea too. I used in many cases in the 60' a delayed relay (rectified heater voltage can be used to add a 555 or else) with relay that connect the HV after 10 sec or more. Did that in many receivers, automation circuits and more (miss those days). Another story, for those who insist to use rectifier tubes, the circuit has an engineering problem. I dont have the schematics in front of me but I remember that the circuit is grounded at one side and at the cathode is under HV, that means that there is hv between the cathode and the filament, the 26Z5 in this case is made to resist but in many cases the isolation between the cathode and the filament fail. In many countries a separate floating coil was made in the main transformer just for the rectifier tube to avoid this stress. if you use solid state rec. you eliminate also this problem.

Date: Wed, 24 Jul 2019 19:02:06 -0400

From: "John Gedde" <jgedde@optonline.net>
Subject: Re: [R-390] Two new tutorials posted on the R390A FAQ site

I like to be clarified about applying HV before the filaments. I just can't see this being a bad thing at the voltages we're dealing with. I've heard of cathode stripping, but I can't see that occurring under the conditions we see in these units - <450V, low possible currents. Cathode stripping could occur due to corona, but unless the tube is already gassy, I can't see it actually happening. With no heat, no thermionic emission can occur and the plate/cathode/grids are just metal with a voltage on it in a vacuum. Vacuum is good, partial vacuum is bad with regard to corona. I see delayed application of B+ often in audio amplifiers, but I can't help but wonder if the fear of cathode stripping is just an urban myth.

The use of solid state rectifiers predates the R390 and R390A. Indeed, the selenium rectifier has the same issues as a silicon diode and the selenium rectifier has extensive heritage with VT circuits.

I continue to use rectifier tubes in my R390, R390A and all my other antique radios for originality and to avoid issues with high B+. I have designed a circuit that emulates the characteristics of the 26Z5 as a full-wave rectifier, but have never built it. It works in PSPICE for what that's worth. If I ever go with SS, I'd use a filament transformer wired in buck to lower the line voltage and make a box to house it. I may do that anyway since line here is 122V which equates to about 25-30V or higher unloaded B+ in my R390A. Using my Variac is an unwanted nuisance for casual use.

As a fellow EE I'd be very interested in hearing the physics behind the HV before filament concern.

Date: Wed, 17 Mar 2021 17:29:50 -0500
From: "Ron.K3PID" <ron.k3pid@sbcglobal.net>
Subject: [R-390] FL-101 for R390/URR

I am in need of the power line entry filter which includes the 4 pin connector for the R390/URR. I assume that the potted assembly can not be opened for repair!

Date: Wed, 17 Mar 2021 22:45:17 -0000
From: "Fred Moore" <fred_moore@usa.net>
Subject: Re: [R-390] FL-101 for R390/URR

Is it potted, or simply soldered? If soldered, you may be able to replace the capacitors, if needed. Of course, if there is a replacement available, that is easiest.

Date: Wed, 17 Mar 2021 19:36:26 -0400
From: "thoyer" <thoyer1@verizon.net>
Subject: Re: [R-390] FL-101 for R390/URR

They are packed in a wax type material and blocks of wood - yes wood! I just recently took mine apart and replaced the internal caps with new AC XY caps. Used a torch - gently - to get the lid off and back on.

Date: Thu, 18 Mar 2021 00:19:04 +0000
From: Kevin Schuchmann <kschuchmann@protonmail.com>
Subject: Re: [R-390] FL-101 for R390/URR

Here is a link to a gentleman that un-soldered the filter and replaced bad caps.
http://www.chavfreezone.me.uk/2018/R390-mains-filter.html

Date: Wed, 17 Mar 2021 20:54:50 -0400
From: T Via <charlestimothyvia@gmail.com>
Subject: Re: [R-390] FL-101

The FL-101 is potted and not repairable from a practical standpoint. Has capacitors leaky enough to trip a ground fault outlet. Other than that filter still seems to work as intended. If a good one is not found the work arounds are as follows:

1. Use a grounded (3 wire outlet) that is not a ground fault outlet For safety have a ground wire from the R390 to any other vintage equipment that can be touched simultaneously with the R390 to avoid a potentially dangerous shock from the "hot" chassis of the R390.

2. Use a line isolator transformer with the ground fault outlet but you still need to have a chassis ground wire to other equipment as mentioned above.

3. Discard the filter and replace it with a generic line filter with a similar schematic diagram.

4. Wire it up without any filter. Whether this is practical depends on how much line noise there is in your shack. Mine works fine without any filter.

5. Try a line filter from a R390A (I have not done this but it seems like an idea to consider. But it wont fit in the existing hole in the chassis for the R390 filter
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Date: Wed, 17 Mar 2021 21:03:47 -0400
From: "thoyer" <thoyer1@verizon.net>

Subject: Re: [R-390] FL-101 for R390/URR

Interesting link - exactly what I found in mine. It actually was a pretty easy job.

Date: Mon, 2 May 2022 12:01:13 -0600
From: "Jordan Arndt" <Outposter30@shaw.ca>
Subject: [R-390] R-390A FL-101 repair/replacement...

Hi group... I'm going to have to replace FL-101 in 2 receivers, and I'm considering installing those Corcom computer type line filters in their place. One has a broken solder connector on the B side of the filter output, and the one I was going to use to replace it shows both ~100uA leakage at ~200VDC and <10Meg of insulation resistance in both the A and B lines measured with my TO-6. I also tested the broken filter for comparison, and there is no DC leakage at all, and the insulation resistance is as near to infinite as I can measure on the TO-6.

What is the recommended method to enlarge the opening in the rear panel to the necessary dimension..?

Would a Dremel tool with a cutoff wheel work..?

Any tips are greatly appreciated....!

Date: Mon, 2 May 2022 14:33:38 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] R-390A FL-101 repair/replacement...

Instead of modifying the rear panel, I would opt for a filter that mounts on some existing holes in the inside and has lugs for wiring, etc. I just don't like to cut on a radio if it's necessary. Thanks, Barry - N4BUQ

Date: Mon, 2 May 2022 18:50:55 +0000 (UTC)
From: Thomas Hoyer <thoyer1@verizon.net>
Subject: Re: [R-390] R-390A FL-101 repair/replacement...

I rigged up a plate that screws onto the rear of the enclosure using existing holes on a couple of my 390A's. I Have some studs coming through just like the filter. I can send some pics if interested.

Date: Mon, 2 May 2022 22:16:00 -0700
From: Larry H <larry41gm@gmail.com>
Subject: Re: [R-390] R-390A FL-101 repair/replacement...

Hi Jordan, I had to replace a filter on one, also. You are right that

there should be on dc leakage to grnd from either side of the line. I decided to use a corcom to avoid the GFI tripping issue. The one I used was a 20VK1, as it fit nicely in the space and I only had to drill one 1/8" mounting screw hole. I used an existing hole for mounting the other end. I attached a pic of it in place.

Date: Tue, 3 May 2022 09:48:50 -0600
From: "Jordan Arndt" <Outposter30@shaw.ca>
Subject: Re: [R-390] R-390A FL-101 repair/replacement...

I've received several responses so far, and I hope you guys keep them coming...! For the time being, I"ve opened the old filter and pulled out the coils and caps and wired jumpers directly from input to output bypassing those lines with .01uF @ 2KV. At least that way, I can finish the work on that receiver before deciding on a final replacement method of FL-101 in that rig. I found that each line has 2 toroidal inductors, one large at the input and one small to the output with caps across the large inductor to the case of the filter and the small inductor in series with the larger one, connected direct to the output connectors. There is a lot more stuff in there than I had expected, and it's all double wrapped in a yellow film and then everything is potted in what appears to be beeswax(?).

Date: Tue, 3 May 2022 12:12:58 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] R-390A FL-101 repair/replacement...

If I remember correctly, I opened one of those and merely used the connection points to wire a chassis-mounted filter. That kept the line input looking original from the outside.

Several years ago, I had some adapter plates made that allowed a filter with a built-in IEC connector to fit on the back and used the same holes as the original filter. That seemed to be the better approach and made for a nicer line cord socket arrangement (albeit some folks don't like having to keep IEC power cords around for such uses).

Date: Tue, 3 May 2022 16:25:32 +0000
From: Gordon Hayward <ghayward@uoguelph.ca>
Subject: [R-390] FL-101

I wonder about bypassing both sides of the line with caps. If the ground ever comes off, the caps act as a voltage divider putting the chassis at 58 VAC which is enough to fry stuff and bite. I've been bitten.

Date: Tue, 3 May 2022 17:50:45 +0000 (UTC)
From: Thomas Hoyer <thoyer1@verizon.net>

Subject: Re: [R-390] R-390A FL-101 repair/replacement...

When I took apart the input filter on a 390 it was also packed in a wax type of material and they used small pieces of wood to hold the parts in the desired location until the wax cured. I removed all and put in a couple XY caps and then soldered the cover back on.

Date: Tue, 3 May 2022 14:48:52 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Corcom filters

I posted this in the R-390A group about twelve years ago. It is still applicable;

Here is where the datasheet is for the hospital grade filter. It's real benefits are for the extraordinarily low leakage current.
http://www.corcom.com/Series/Medical/HQ/

I use the 6EHQ3.
Check out the specs for attenuation up to 30 MHz.

Date: Thu, 5 May 2022 11:41:13 -0600
From: "Jordan Arndt" <Outposter30@shaw.ca>
Subject: Re: [R-390] R-390A FL-101 repair/replacement...

I'd like to thank Barry, Jacques, Ms. Hayes, Tom, Jim, Larry et al for their tips and advice on replacing/repairing FL-101. I received a lot of info to consider, but for now, I'm back to the dealing with the last few remaining issues with this 1960 S-W.

Date: Thu, 5 May 2022 18:00:11 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] R-390A FL-101 repair/replacement...

Jordan: whichever way you go, let the list know the outcome. It's always helpful to know the path taken and if there are any unforeseen issues that need to be addressed. Jim
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Date: Fri, 7 Oct 2022 15:13:04 -0500
From: "Les Locklear" <leslocklear@hotmail.com>
Subject: Re: [R-390] R-390 Antenna Relay Chatter

Like Jordan said...the voltages are pretty much the same. I would just replace it. The few pieces of tube gear I own all have a thermistor and am using a bucking transformer to provide 115 Volts AC.

Date: Fri, 7 Oct 2022 16:20:22 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] R-390 Antenna Relay Chatter

Thanks, Les. I'm currently "soft-starting" it with an autotransformer and setting it to 115VAC for final run voltage. I plan to add the thermistor and possibly a bucking circuit as well.

Date: Fri, 7 Oct 2022 16:20:13 -0400
From: "wc4g@knology.net" <donwc4g@gmail.com>
Subject: Re: [R-390] R-390 Antenna Relay Chatter

I don't think the B+ will soar in an R-390 because the B+ is regulated. Not so in the "A" model. That is where I think this issue originated. The antenna relay is only energized in STBY, BRK IN or CAL. As soon as the FUNCTION switch is turned to STBY, the B+ comes up. The B+ will increase only if the regulator circuit develops a problem and regulation is lost. (R-390) All of my equipment "sees" ~117VAC due to my BIG bucking transformer.

Date: Fri, 7 Oct 2022 20:30:46 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] R-390 Antenna Relay Chatter

One would have to assume that the Collins people who designed the R-390and the R390A knew what they were doing. True, the B+, like anyother voltage, will rise as the load is decreased. But I amconfident that this rise was accounted for in the original designs bycompetent engineers. Asfor AC line voltage increasing over the years, this is simply a misunderstanding of the line voltage conventions which started wayback in 1927 with the beginning of AC powered radios. Whenthe Edison Three Wire DC Distribution System was adopted for use withAC, there were two voltagechoices for AC powered devices in the home. In the very beginningthese voltages were either115vac or 230vac. Overtime, as demand for electric power grew, more distributiontransformers were added to the local distribution system whichreduced IR losses and this reduced line voltage fluctuations. 115vac,117vac and 120vac line voltages are just voltage standards, used todifferentiate between the two Edison inspired AC voltages availableto the home and not the actual line voltage present at the "socket."One cannot expect the AC line voltage to remain at a steady statevoltage throughout the day under the varying loads presented to thedistribution system. Theactual line voltages for the three standards are:115vac +/- 10% or 103vac to 127vac117vac +/- 7.5% or 108vac to 126vac120vac +/- 5% or 114vac to 126vac The three rating standards above are the result of surveys done in the1920's, 1940's and 1960's by either NEMA (National ElectricalManufacturers Association) or

other groups that also included NEMA orit's later incarnations. The purpose of these standards was to set arange of line voltages for equipment manufacturers that would beavailable across the country. The"Ratings" page from the first NEMA standard in 1927 isenclosed. As you can see, themaximum line voltage was around 126vac from the very beginning of "ACSocket Power." Thelower line voltage limit and the resulting average voltage were theonly voltages that changed in all of the subsequent standards as this specification was tightened.

As for adding a resistance to a silicon diode to better mimic thevoltage drop of a Selenium rectifier, it is neither needed nordesired. Simply stated, the Selenium rectifier is a crappyrectifier. In addition to taking up so much more real estate it isgreatly affected by ambient and operating temperature. Theaverage voltage drop of a silicon diode is one volt. The averagevoltage drop of a Selenium rectifier cell is also one volt. Because most Selenium rectifiers have a relatively poor reverse voltagerating, most Selenium rectifiers are a stack of four or more cells. This three volt increase in B+ by changing from Selenium to silicon is swamped by the normal line voltage variation of the AC distribution system. If the goal in power supplydesign is to have decent voltage regulation then eliminating any series resistance will also reduce IR loss which is currentdependent, by definition.

Date: Fri, 7 Oct 2022 19:28:40 -0400
From: Glenn Little WB4UIV <glennmaillist@bellsouth.net>
Subject: Re: [R-390] R-390 Antenna Relay Chatter

I would suspect that the selenium rectifier has gone the way of all aging selenium rectifiers and has an increased voltage drop across it. Change the rectifiers to silicon and add a dropping resistor to get the relay voltage in spec and all will be good. Dropping resistor may not be needed.

Date: Fri, 7 Oct 2022 21:31:46 -0400
From: John Wendler <wendlerjrv@gmail.com>
Subject: Re: [R-390] R-390 Digest, Vol 220, Issue 6

I went looking for info on Selenium Rectifiers and came across this link, fwiw. https://www.antiqueradios.com/forums/viewtopic.php?t=305477 Includes a link to a Selenium Rectifier data book and a nice discussion thread. I've never done any modeling myself.

Date: Sat, 8 Oct 2022 17:37:27 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: [R-390] Selenium rectifier, was: R-390 Antenna Relay Chatter

I'm not sure of how the Selenium rectifier actually fails. Lots of speculation abounds but there seems to be no hard evidence. One take on the failure mode can be found here:

http://www.ase-museoedelpro.org/Museo_Edelpro/Catalogo/Overview/Articles/selenium%20rectifiers.pdf

One curious observation is that there is little to no data, from any manufacturer, on the reverse current of the Selenium rectifier. Has anyone disconnected the load from the rectifier circuit and then measured the voltage across the low ohm current limiting resistor with an o'scope to calculate reverse current? An isolation transformer would be helpful!
As everyone knows, the reverse current in silicon rectifiers is in the microamp region. I suspect that the normal leakage current in Selenium is in the single digit milliamp region as Emilio describes or perhaps even higher. If this reverse current raises as the reverse voltage knee approaches zero then this can certainly produce the heat needed to cause rectifier failure.--<clip>------
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Date: Sat, 8 Oct 2022 15:07:30 -0400
From: Glenn Little WB4UIV <glennmaillist@bellsouth.net>
Subject: Re: [R-390] Selenium rectifier, was: R-390 Antenna Relay Chatter

https://en.wikipedia.org/wiki/Selenium_rectifier

Date: Sat, 8 Oct 2022 18:00:38 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] R-390 Antenna Relay Chatter

From what I can find in the manual, the relay's coil resistance is 17 ohms the 26.2VAC winding is center tapped. If that's the case, then that relay pulls about 0.74A. Is that correct? It seems excessive but maybe not. I'm just wanting to make sure the bridge I get is rated properly.

Date: Sat, 8 Oct 2022 18:29:24 -0400
From: Bob kb8tq <kb8tq@n1k.org>
Subject: Re: [R-390] R-390 Antenna Relay Chatter

Given that anything below 1A is a dirt cheap “modern” diode and that you have two of them sharing the load. Not a big deal. The cheapest of the cheap should do the job.

Date: Sun, 9 Oct 2022 07:52:09 -0700
From: Larry H <larry41gm@gmail.com>

Subject: [R-390] R-390A Use of Stand By on Function switch

I think the 'Stand By' position on the Function switch has gotten a bad rap. Yes, there are some issues with using it, but it's not that bad. The problems that I know of are:

1. cathode deterioration on those tubes that are not powered with B+ (IF deck and some of the RF deck (the oscillators are normally powered)). Since the BFO and Cal oscillators are off most of the time (B+ removed from the screens and plates), the cathode deterioration issue is really not much of a consideration.

2. Higher current draw on the 2 audio output tubes, 6AK6's. In order to assess the impact on these tubes, we need to look at the increased voltage on them, it's 17 volts at C606A. That is, of course, if your 390A is working correctly. The voltage at C606A only goes up 17 V, from 205 V to 222 V. The voltage on the 2 output tubes is less than that, so the voltage increase is also less. But this will still shorten the tube life only very slightly. 3. The OA2 150 V regulator is not affected. 4.The capacitors in the rx are not going to be affected by the small voltage increase in stand by because it is still way less than the startup voltage of 242 V.

So yes, don't leave it in stand by for more than a few hours, if you can help it. The recommended maximum length of time in stand by is 30 minutes, but I think that is a little conservative. I feel comfortable with a couple of hours a day. Remember, this is all based on the rx having the correct input voltage, 115vac. I feed my 390's and some of my other toys from a large bucking transformer for this reason.

Date: Sun, 9 Oct 2022 19:47:20 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] R-390A Use of Stand By on Function switch

Larry, I agree with you, it is a nonissue. The issue of "cathode poisonings" or "sleeping sickness" affected early tube based computers. Operating a tube at cutoff for extended periods of time, like in a flip-flop, resulted in reduced plate current when normal conduction is first resumed. This problem was addressed by the late 1950's by requiring that the cathode nickel sleeve be made of high purity nickel. It was the trace elements found in the nickel that contributed to the interface resistance issues between the cathode oxide and the nickel sleeve.

All tubes manufactured after 1960 or so, depending on the manufacturer, have incorporated this high purity nickel cathode sleeve material so if there is a problem, perhaps changing the tube to one with a manufacturers date after 1963 or so will eliminate the problem. If the

tube is not replaced, normal plate current should be restored anyway after a few minutes of operation at normal plate currents. This sleeping sickness is not a permanent condition and does not cause tube failure.

The BFO, 1st Crystal Oscillator and the 100 kc Calibrator do not operate continuously in the R-390 or R-390A. In fact, it is possible that any one of these three stages may not be used for hundreds of hours at a time but are still available at the flick of a switch. If Sleeping Sickness was a real problem, then many more complaints would be posted about these stages failing more often due to tube sleeping sickness, don't you think.

On the continuing line voltage discussion:

- Preliminary Manual, 1953, for the R-390 states on page 13. paragraph 10 that the PP-621 power supply will operate on either 115 or 230 vac +/- 10%, 48 to 62 cycles.
- TO 32R1-3URR-412 calls out a bit tighter voltage for testing of 115 vac +/- 5% 60 cycles on page 130.
- NAVSHIPS 0967-063-2010, (1970) lists 115 or 230 vac +/- 10%, 48 to 62 cycles on Page 1-4.

All of the other R-390 and R-390A manuals that I looked at go no further then to call out 115vac or 230vac with no AC voltage or line frequency tolerance provided, or at least I didn't easily find it. <grin>

I suspect that those who use a bucking transformer to lower the nominal line voltage will have tubes and components that may last a bit longer over the operating life of the receiver but I don't know how noticeable this will be. The reduced voltage will still vary over the present +/- 5% line voltage tolerance unless the VARIAC is automated. Heat being the enemy of reliable electronics, I would think that better air circulation to remove heat would accomplish the same thing if not more. This is especially true in the R-390 with it's regulated B+ power supply.

Date: Sun, 9 Oct 2022 21:53:24 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] Selenium rectifier, was: R-390 Antenna Relay Chatter

Glenn: I've seen this link before but frankly it doesn't make any sense to me. If you increase the foreword resistance of the Selenium rectifier, then the foreword current must decrease. Less current, then less I^2R loss, so not a great increase in heat. Now if the crappy Selenium rectifier reverse voltage drop decreases, then more reverse current will flow, so a greater I^2R loss, so much more heat.

This second scenario does make sense to me so I'm in the Emilio Ciardiello

camp but I go much further then he does. I don't bother trying to repair them, I replace them! Read his paper (link is below), if you haven't already; it is interesting.

The foreword to reverse current ratio in a typical Selenium rectifier is about 500 mA to 8 mA or 62.5 times the reverse current. The silicon 1N4007 is 1 amp to 5 microamps or typically 200,000 times the reverse current. The higher reverse current in Selenium will, at least, increase the power supply ripple voltage so this may be an overlooked reason for the higher B+ voltage when Selenium is replaced by silicon.

Date: Sun, 9 Oct 2022 20:22:50 -0400
From: Bob kb8tq <kb8tq@n1k.org>
Subject: Re: [R-390] Selenium rectifier, was: R-390 Antenna Relay Chatter

Back in the day the state of the art was a selenium rectifier. They beat the copper oxide stuff out by a wide margin. We went through Germanium and have now forgotten about them. Silicon is not the “best of the best” but it sure wins the “lowest cost” race by a wide margin.

If you want to keep the radio in “as issued” shape the indeed dig around for the original part. The same thing applies to the tube / silicon diodes you use for the HV supply. It also applies to that ballast tube (which Fair Radio seems to have in stock). It is *very* much up to you. There is no right and wrong here. You need to decide on what is right for your radio.

Performance wise, go with the silicon stuff. Cost wise, go with the silicon stuff (by a very wide margin). Reliability / MTBF wise, silicon wins yet again. Yes, it might be silicon plus resistor or this or that, but the net result is the same. If you have ever had a selenium die and stink up the shack, I’d say you likely would vote silicon as well. Yes that’s just a personal opinion (based on a really stinky shack).

Date: Sun, 9 Oct 2022 21:01:08 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Selenium rectifier, was: R-390 Antenna Relay Chatter

For CR801, I'm definitely going with silicon. The clock has already been ticking on any original replacements and it just isn't worth it for this application. I fabricated a small bracket that uses the original mounting hole for the selenium stack and had intended to mount four standoffs with four 1N400x diodes in a bridge but then I realized that the 1N400x is only good for 1A which is a bit closer to the required current than I'm comfortable with. I've ordered a packaged bridge that will still mount on

that bracket so it wasn't an entire waste of time to make it.

I hesitate to replace some of the other rectifiers (e.g. the 26Z5Ws) with silicon as voltage drop then does become a bit of an issue. Besides, I kind of like tubes.

Date: Wed, 12 Oct 2022 15:14:24 +0000 (UTC)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] Selenium rectifier

I agree with Barry re that OEM selenium rectifier. I replaced my expensive 26Z5's with 12BW4's, and replacing the old discolored tube sockets with new ceramic ones and some minor rewiring. Has worked out swell for over a decade now.

Our house power varies more than I like, so I have a home-brew AC volt-ammeter mated to a Variac for a monitored soft-start. At least I know what's happening when I power up.

Date: Thu, 13 Oct 2022 05:49:46 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] R-390A Use of Stand By on Function switch

Larry: I looked for maximum cathode or plate current specs but did not find any listed in the 6AK6 RCA datasheet. The European tube manufacturers quote 21 mA as the maximum cathode current. The curves that accompany the tube data indicate that plate current will increase less then 1.0 mA when the plate voltage goes from 200 to 300 volts. This is what one would expect from a pentode. I have no long term maintenance experience with the R-390A. Perhaps someone who maintained a group of them will share their military experience with the reliability of the 6AK6. The only thing that comes to mind is a leaky coupling capacitor driving the 6AK6 stage. Other then that, I am at a loss to understand what the issue is and why the Navy issued the EIB 895 maintenance tip on the 6AK6 as used in both the R-390 and R-390A.

Date: Fri, 14 Oct 2022 00:21:17 -0700
From: Larry H <larry41gm@gmail.com>
Subject: Re: [R-390] R-390A Use of Stand By on Function switch

Jim, As I understand it, a typical pentode's plate current varies as the screen voltage varies. In the 390A, the screen voltage is always higher than the plate voltage, so when the audio B+ goes up, the screen and plate go up about the same amount. This causes the cathode current to rise quite a bit when they go up.

When the screen voltage is at a constant specific voltage, then varying the plate voltage drastically does not cause the plate current to vary that much. But, that is not the case in the 390A, the screen voltage goes up when the B+ goes up.

When the Navy converted the tube rectifiers to silicon diodes (without the dropping resistor), the audio B+ went up causing the audio output tubes to deteriorate at an unreasonable rate, thus EIB 895 to fix that problem.

Date: Fri, 14 Oct 2022 17:48:36 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] R-390A Use of Stand By on Function switch

Agreed, G2 will have some affect on plate current. The tube manual data does not specify what happens when G2 is at the same potential as the plate and both are above 180 vdc. To determine just how much of an affect this will have, one will need to do some experimenting at various B+ voltages from say 180 to 250 vdc. That said, the 6AK6 still appears to be operating within design center values.

In addition, cathode self bias is used so the higher the plate current, the more negative the control grid bias. Add to this that there are three feedback paths really complicates a paper analysis. For some insight of what the designers took into account, the below is from the R-390 Final Engineering Report.

"Local Output: one half of a 12AT7 grid is fed from the local gain control. Its plate is coupled to the grid of the 6AK6 local output tube. Negative feedback is employed from the plate of the 6AK6 to the cathode of the12AT7 to reduce the output impedance. This negative feedback reduces the voltage gain considerably and in order to bring it back up to a reasonable level a small amount of positive feedback is provided bymaking a fraction of the cathode resistors of the half 12AT7 and 6AK6 common to both tubes. The effect of the positive feedback is to cancel the negative current feedback developed across the cathode of the half 12AT7 and so raise its gain."

The Navy EIB 895 was an option, not a requirement so I have no idea how often this modification was actually incorporated into the R-390A. Still think it is poorly thought out and that perhaps the addition of a screen grid resistor might have been more effective and much easier to implement. But this would again affect gain and further complicate matters.

Date: Thu, 20 Oct 2022 13:30:15 -0400 (EDT)
From: Barry <n4buq@knology.net>

Subject: [R-390] Odd Splice In Fuse Area - R390

In the area inside the rear, lower section where the three fuse holders are, I discovered a bundle of three small wires that have been gathered and soldered together and then encased in a rubbery-sticky sort of insulator.

While trying to determine another problem with wiring in that area, I suspected a bad connection there and unwrapped that insulator. The three wires (one white with a red stripe and two white with red and orange stripes) were solidly soldered together; however, it leaves me to wonder why those were done that way. Those wires go into larger cables and, as such, not sure where they might go or whether they might have been connected to something else that might have since been removed.

Anyone know anything about that? I really don't know if that "patch" belongs there or whether I should be looking for missing parts.

Date: Thu, 20 Oct 2022 13:42:36 -0400
From: Bob kb8tq <kb8tq@n1k.org>
Subject: Re: [R-390] Odd Splice In Fuse Area - R390

An ohm meter that goes beep when you hit a connection is your friend in this case. Clip one side to the splice and then start randomly dragging the other end over the various chassis / front panel connections. If you get lucky (and you might) you'll get a beep without digging into / dismounting any sub assemblies/

Date: Thu, 20 Oct 2022 13:44:53 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Odd Splice In Fuse Area - R390

I'd considered that. If this is the DL connection that Jordan is asking about, then that's the easiest route but, if not, then I'll have to go hunting.

Date: Thu, 20 Oct 2022 13:58:41 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] Odd Splice In Fuse Area - R390

Barry, isn't it the result of the wiring change that moved the HV fuse from the +B (unregulated) to the HV transformer center tap ? See in the Correction issue #2 (C2) of the TM-11-856. I will send you this one separately

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Date: Thu, 20 Oct 2022 14:06:53 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] Odd Splice In Fuse Area - R390

And read also the beginning of section C4 !

Date: Thu, 20 Oct 2022 16:05:31 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Odd Splice In Fuse Area - R390

Yes, that's it. I checked continuity to/from the appropriate points and confirmed it.

Date: Fri, 21 Oct 2022 21:32:29 +0000 (UTC)
From: Norman Ryan <nnryann@yahoo.com>
Subject: Re: [R-390] Odd Splice In Fuse Area - R390

Hi, fellow boatanchor mavens, go to this link for the corrections that Jacques mentioned. They are right at the beginning of the manual.

https://www.collinsradio.org/wp-content/uploads/2012/04/R390-TM11-856_Part_I_BW.pdf
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Date: Sun, 30 Oct 2022 19:16:54 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Corcom filter replacement for FL101

The attached PDF on using a Cocom filter may be useful.
---------- next part ----------
A non-text attachment was scrubbed...
Name: Replacing FL101 in the R-390A Rev 2.pdf
Size: 155138 bytes
URL: <http://mailman.qth.net/pipermail/r-390/attachments/20221030/67b15ea3/attachment.pdf>

Date: Thu, 29 Dec 2022 10:56:22 -0500
From: John Wendler <wendlerjrv@gmail.com>
Subject: [R-390] R390A power cord specifications

Does anyone have an authoritative specification on the power cord for the as-shipped R390A? I do not see a length requirement in MIL-R-13947B and have not yet spotted a part number in the manuals that I looked at. The power requirement (275 Watts, max) in conjunction with the lower voltage (115 VAC) says the maximum current that cord will carry is about 2.4 Amps. The brackets that capture the power cord on the rear panel set a maximum outer insulation diameter of approximately 0.36 inches. 18/3 SOOW should work, but I was wondering about the historical lore. I expect that installers would have chopped or replaced as necessary for a neat installation.

As an aside, one of my units came with a plug that had a rotatable ground pin for use with either 2-wire or 3-wire power outlets. Point the pin forward for 3-wire outlets; rotate it 90 degrees out of the way for the 2-wire outlets. The ground wire is secured by a lug to the screw that the pin rotates around.

Date: Thu, 29 Dec 2022 09:48:25 -0700
From: <gary.biasini@shaw.ca>
Subject: Re: [R-390] R390A power cord specifications

Please see attached.
---------- next part ----------
A non-text attachment was scrubbed...
Name: SM-B-32233 - AC Cable.pdf
Type: application/pdf
Size: 166701 bytes
Desc: not available
URL: <http://mailman.qth.net/pipermail/r-390/attachments/20221229/1c767f38/attachment.pdf>

Date: Thu, 29 Dec 2022 18:14:49 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] R390A power cord specifications

The line cord for the R-390 is CX-1358/U which is an 8 foot long with two 18 AWG conductors for hot and neutral. There was no ground wire as part of the power cord in the original R-390.??See: https://aerospace-supplies.com/wire-assemblies/electrical-power-cable+assembly/cx1358u I would expect that this specification was carried through with the later R-390A but with an added ground wire.

Power consumption for the R-390 is 270 watts with ovens on and 170 watts with ovens off, per the manual. Power consumption for the R-390A is 250 watts with ovens on and 140 watts with ovens off, per the manual. >From previous posts on line voltage:115vac,117vac and 120vac line voltages are just voltage standards, used todifferentiate between the two Edison inspired AC voltages availableto the home (originally 115 & 230), not the actual line voltage present at the outlet. One cannot expect the AC line voltage to remain at a steady state voltage throughout the day under the varying loads presented to the AC distribution system. The actual line voltages for the three standards are:115vac +/- 10% or 103vac to 127vac 117vac +/- 7.5% or 108vac to 126vac 120vac +/- 5% or 114vac to 126vac. These three line voltage standards are the result of surveys done in the 1920's,1940's and 1960's by either NEMA (National Electrical ManufacturersAssociation) or other groups that also included NEMA or

it's later incarnations. The purpose of these standards was to set a range ofline voltages for equipment manufacturers that would be available across the country. . As you can see,the maximum line voltage was around 126vac from the very beginning around 1927. The lower line voltage limit was the only voltage raised in the subsequent standards. I would think that maximum power consumption would be at the high line voltage limit (126 vac), not at the average line voltage.

I personally have not seen installers modify line cord lengths when equipment is installed in racks. That would handicap operation on the workbench during repairs or the installation of the R-390A at another rack position. The plug you mention is the UP-131M. Besides having a rotatable ground pin, the neutral prong was wider then the hot so that it was polarized?and would not allow a reverse insertion into a socket. There are at least two other models made by the same manufacturer, the APM company. The original UP-120 with no ground pin and non polarized with both prongs the same width and a second with an external fixed ground pin which could be installed facing away from the socket so that it would mate with either a two or three conductor socket.

Date: Thu, 29 Dec 2022 18:26:10 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] R390A power cord specifications

Drawing title block says for R-390A/URR & R-392/URR

Date: Fri, 30 Dec 2022 09:41:22 -0500
From: John Wendler <wendlerjrv@gmail.com>
Subject: Re: [R-390] R390A power cord specifications

Gary and Jim, thank you for the detailed replies. That was exactly the kind of authoritative info I was looking for. The drawing dates to 1956, so I'm not surprised by the lack of ground wire. The connector on the radio end surprises me - both of my radios have studs for circular crimp lugs.

Date: Fri, 30 Dec 2022 09:46:20 -0500
From: John Wendler <wendlerjrv@gmail.com>
Subject: Re: [R-390] R390A power cord specifications

Don, thanks! My wife (Mom's house is largely 2-wire) and I admired the elegance of design, but I wondered if the feature was reliable enough in actual use.

Date: Sun, 21 May 2023 10:10:29 -0400
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>

Subject: [R-390] Transformer restoration?

Anybody know how to refinish the power transformer, including the cool silk-screened graphics? Is there a way to use your computer printer to make a silk-screen mask? I can make up, say, an Illustrator file with the graphics, but I'm not sure what to do with it.

Date: Mon, 22 May 2023 01:04:30 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] Transformer restoration

In college, some 45 years ago, I took a one term elective which was composed of photography, silk screen, typeset printing and rubber stamp making. It gave me an insight to what was involved in making alumina test fixtures and circuits, MMICs and integrated circuit mask making, in general. The process starts with the making of a transparency containing the image. Then coating a silkscreen with a photo sensitive solution, drying the solution and contact printing the image onto the silkscreen and then washing away the image that was not exposed to light. Light hardens the photoresist and what was not exposed to light dissolves in water. Nothing is expensive or hard to do but it is a skill that needs some practice to master. Things to know are the mesh count of the silkscreen which defines the resolution of the image and what type of ink or paint used and it's viscosity that will allow the image to transfer to the object i.e. transformer through the silkscreen. There are a lot of YouTube videos on the process, not all that hard or expensive but it will be a bit time consuming. eBay has the silkscreen, paint can be found everywhere. What I know of you, you will enjoy the process. I certainly did!

Date: Mon, 25 Sep 2023 11:13:14 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] need R390a power switch

You can flip your front panel down, then the microswitch on the function switch will become accessible. Remove the two power wires from the microswitch, so it can be removed in-situ. It holds with four 2-56 screws. Take care to not loose the four small washers between the microswitch and the function switch assembly. Once removed, the microswitch itself can be opened and cleaned. I had the same problem with a 1967 EAC: the internal contacts "sticked" closed because they were arcing. I cleaned those and applied a drop of Deoxit. No problems since.