

R390A CARRIER LINE AND VU METERS

From: paul.courson@... (An Unsigned Note)

Date: Fri Nov 28, 1997 8:10 am

Subject: [R-390] Re: Meter Spotting Guide

I'm sorry to see no others have responded to your inquiry. Let me take a shot at it. Some of the information you may want has been broached already -- the older meters have yellowish-brown markings on a black face, and the movement of the carrier level meter of this vintage specifically is known for being "sticky." It can hang both on an upward push and whilst trying to return. The later meters seem to have an improved d'Arsonval movement, and have whiter scale markings with a very slight greenish tint.

Please review the R-390 digest regarding radioactive issues. This relates to something I'll get to in a minute.

On "correct" meters -- this is esoteric, in my view. A completely original radio will have a set of meters. Beyond that, I've seen a variety of meters installed in receivers from any given contract. This suggests later depot replacement and possibly multiple vendors supplying the original assembly line.

Most of the meters carry no markings to identify the vendor. An exception is found on certain units from the Stewart Warner contract, c. 1960. A unit confirmed as having been manufactured in 1962 contains meters with the larger viewing window such like you have noted on one of yours, and a logo-script brand "DeJur," which was a company known for motion picture equipment (I have a mil spec audio amplifier from this company, the IC/QAF-1D, with a pair of 6L6's and an identical VU meter as on the R-390A).

Other meters will sometimes contain a date code stamped on the back. Some of the Carrier Level meters and a few of the VU meters include nomenclature in the lower right corner of the scale starting with "59.xxxx," where the xxxx consists of four additional numbers. No rhyme nor reason established here.

There is another case style to be aware of, typically found on R-390A units from the Amelco contract, c.1962. The outer dimension and thickness of the meter are identical, but the metal face of the meter will feature an indented circle, within which the viewing glass and upper opening curve are situated. Also, the unit markings and typeface are different than the size and typeface of scales found on other meters. Now, back to "correct" issues. Years after the end of production for these radios, a demilitarization project ordered the removal of many meters prior to government surplus auction (also known as Defense Reutilization).

So, not only do you have likely replacement of sticky meters during depot work, but you today also face the prospect of someone having luckily located meters to replace those removed on the way to auction. A pair of meters today sells loose for upward of \$50 (U.S.)

I would not sweat whether the meters are the same ones installed on the assy line.

But if you must satisfy your curiosity, it may help to have a look at the rubber gasket between the back of the meter face and the front of the front panel. If there are multiple impressions on these gaskets (from compression), it suggests the meter has already been out of the set, and not necessarily was the same meter re-installed. Typically the gaskets stick to the panel and remain with the set even if the meters are disturbed.

From: Tom Norris <badger@...>

Date: Sun Nov 30, 1997 8:46 pm

Subject: [R-390] (Meters That Gloweth) was -Re:Meter Spotting Guide

At 11:10 AM 11/28/97 EST, Paul Courson wrote:

>Most of the meters carry no markings to identify the vendor. An exception is found on certain units from the Stewart Warner contract, c. 1960. A unit confirmed as having been manufactured in 1962 contains meters with the larger viewing window such like you have noted on one of yours, and a logo-script brand "DeJur," which was a company known for motion picture equipment

Now, my 1960 EAC has DeJur meters, each with the 59.xxxx date code. My 1963 Imperial has "INTERNATIONAL" above the scales of each meter. No other markings. Both receivers appear original. The DeJur meters are the "older" yellowish type.

>There is another case style to be aware of, typically found on R-390A units from the Amelco contract, c.1962. The outer dimension and thickness of the meter are identical, but the metal face of the meter will feature an indented circle, within which the viewing glass and upper opening curve are situated. Also, the unit markings and typeface are different than the size and typeface of scales found on other meters.

My 1963 WeCo R-392 has this type of meter. This is its original as well, as it was gotten "new in the crate". Same type as on my CV-278 RTTY demodulator, and my '63 WeCo T-195. My older 1952 Stewart Warner '392 had an International, almost identical style as the one on my 1963 R-390A.

>Now, back to "correct" issues. Years after the end of production for these radios, a >demilitarization project ordered the removal of many meters prior to government surplus >auction (also known as Defense Reutilization).

For fear of being flamed: "Oh NO! Radiation! We're gonna DIE! Run! Run Away! [Making fun of the folks who declared 390 meters and GI compasses RadHazMat!] As a rule- the radioactive meters will not be harmful if still sealed. Do not inhale or eat the paint flakes if you take one apart and ALWAYS wash your hands after handling the meter faces. Clean up any paint flakes with a damp cloth and dispose of properly. The problems with the radium meters come about with prolonged and repeated exposure, so cleanup is a must. Avoid taking the meter apart if you can

help it. The meters on my R-390A's measure between 2-6 mR/hr beta, or 2000-5000 counts /min alpha emission at the meter face, none above background at a normal operating distance - say 4-6 inches. So, avoid handling the bare meter faces as much as possible, but dont be afraid to stay in the same room as your radio. And avoid carrying one* around in your pocket on a daily basis.... :-) On replacement meters -- there was a guy that put together some kits earlier this year with replacement faces that matched the standard 390/390A style. I have emailed him and will pass the word on to the list if still available. The kits were around 30.00, DIY type - take the meters apart, apply adhesive scale, reassemble.

Date: Wed, 6 Jan 1999 20:20:56 EST
From: DCrespy@aol.com
Subject: [R-390] Meter Specs

The Carrier meter is a 1 mA movement, but the key to getting it to work is the internal resistance.. From HSN, I've heard that the movement should be 17 ohms. I have measured new and used ORIGINAL meters around 17 to 20 ohms. I have have good luck making 35 to 40 ohm meters work. I could not get the most common 100 ohm one to work well. The Line Level meter is a regular AC Vu meter.

Harry KG5LO Saline MI

Date: Wed, 06 Jan 1999 22:13:34 -0500
From: Will Schendel <n8azw@megsinet.net>
Subject: Re: [R-390] Meter Specs

I just measured four ORIGINAL used Simpson carrier meters that seem to work well, they read 17.3 to 18.0 ohms resistance. Hope this helps to confirm the meter resistance question...

Date: Thu, 07 Jan 1999 10:14:05 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Rebuilding meter faces

You might tape everything back in place with magic tape. Then xerox onto fine bond paper, several copies and glue the paper to the scale with none rubber cement. I've not found the perfect glue. I do that for the scale of my rotator to get it south centered. Trimming the paper at the edge around the movment is very important.

Date: Thu, 07 Jan 1999 14:27:08 -0800
From: dma@islandnet.com
Subject: Re: [R-390] Meter Specs

I came across this problem when attempting to make some very nice brand new black faced 1 ma meters work, and they didn't. I first thought that I had a problem somewhere in the meter bridge circuitry, but finally decided that the meters were the problem. I had connected an HP410C in place of the meter, on the 1.5 ma scale, and it behaved the way I would expect. My meters were too high a resistance to work properly. I did fiddle with the circuitry a bit to see if it could be made to work

without making permanent changes to the radio. But I finally concluded that I didn't want to mess with this part of the radio because so much depends on it working the way the designers intended.

So what I've done to make the higher resistance meters work (purists should cover their eyes at this point!!) is make a tiny little amplifier and mounted it on the back of the meter. I use a garden variety op-amp and take the power from the high end of the dial lamp resistor. It has a small trimmer that can match the thing to just about any meter that fits the holes and can be easily set up. It's not ideal, but it isn't very visible (especially when the radio's in the rack!) and the Mark II version that I'll build one of these days will be very much less visible.

I won't pay the prices asked for new exact replacements, and even the used ones I've seen have been pretty grotty for the money being asked. Anyway, sooner or later we're going to have to make a lot of compromises to keep these classics running! At least that's my story and I'm sticking to it.

Date: Thu, 07 Jan 1999 14:37:07 -0800
From: dma@islandnet.com
Subject: Re: [R-390] Meter Specs- Addendum

>The Line Level meter is a regular AC Vu meter. >Harry KG5LO, Saline MI

Just a warning. I've come across a couple of different possible replacements for the line level meter. Both are calibrated as VU meters, but neither works exactly the same as the original. For the two types I found, the adaptation was simple - but it's probably useful to check before you buy.

Date: Fri, 08 Jan 1999 01:01:35 -0500
From: Glenn Finerman <glennfin@mjet.com>
Subject: Re: [R-390] Meter Specs

I agree with you 100 percent on all points!. I refuse to pay the not so nice prices I've seen on replacements. And I don't want radioactive originals. That's why I'm looking into having some new replacements made. That may turn out to be just as expensive as what's out there now but I won't know till I try! I really like your idea for the Op-amp board to make the higher resistance meters work. Do you know of a source for these meters? I thought I could just slap in any old 1ma meter as long as it fit..Thanks for the education!

Date: Thu, 21 Jan 1999 00:29:50 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: [R-390] Meter Matters

This is to start/resume another thread. There was some discussion of how to replicate R-390(A) meters. It was mentioned at some point that the impedance was critical on at least one of them, so that even a meter with the same nominal range won't work in the circuit.

Someone else posted an item about making up a batch of repro meters.

I noticed that Fair Radio has at least one meter that is cosmetically identical to the R-390 style. Also have the impression that the mechanics -- particular the armatures on many meters appears similar in size over wide ranges of scales and meter display size. Is it possible to mix 'n match components to make up new repro's that are functionally compatible? (i.e., by swapping armatures and trimming pointer needles if necessary, etc.)

Also ... while they're small with very fine gauge magnet wire, it doesn't seem to be prohibitive to rewind armatures. The only other parameters would seem to be spring tension and flux density of the magnetic frame. Or am I totally off base here?

Black scales could be made on a laser printer on good quality paper and then laminated and trimmed. (As with the badge/luggage tag laminator I have for trade show purposes.) Or probably better -- sprayed with fixative, such as "Blair Spray Fix" made by Loctite. I have used that to make ink-jetted signs permanent and water resistant. It's available in semi-gloss and matte from art supply stores. Whaddaya think? Barry

Date: Wed, 20 Jan 1999 22:32:42 -0800
From: "Tom Roddy" <tcroddy@lightspeed.net>
Subject: Re: [R-390] Meter Matters

Replacement meters are among of those things for which I am always on the lookout. And this is one that I just haven't seen any for. At the risk of offending the purists, I have been looking for meters that are a bit easier to read. Yea, I'll keep the originals in case the BA Police come to inspect, but I'd sure like to put some nice white readable meters in their place. Maybe even lighted!

As far as making new face for meters, the inkjet printer is the perfect tool. I have made new faces on the inkjet and spray over the paper with "Workable Fixative", a product available at any blueprint supply house. Another product available there that gives a glossier finish is called "Crystal Clear". Back when our drafting room had real draftsmen using real pencils on real paper, these products were everywhere.

The information that has been given here re: impedance, etc., shows me that I will never stumble on a box of perfect replacements.

I know that Hammond made up a batch of audio output xfmrs for the BA guys, and to have someone make up a bunch of meters would be great. Both meters are electrically identical, right? So it's only the faces that are different. Are you ready guys -- how about one of the many small manufacturers in Hong Kong, Taiwan, Korea, etc. I know that there are skads of little plants like this, and they advertise for small jobs. Lighted meters would be nice. We can always keep the "real" meters in a safe place.

Date: Thu, 21 Jan 1999 14:51:13 +0000

From: Peter Worrall <worrallp@syntegra.bt.co.uk>
Subject: Re: [R-390] Meter Matters***WARNING***

THE TWO METERS ARE NOT ELECTRICALLY IDENTICAL The line meter is itself a sealed unit accepting audio (alternating current)as its input..... It is scaled 'Volume Units- VU' and responds between about 10c/s to 20kc/s The signal meter is a DC instrument with sensitivity and resistance as quoted elsewhere...I dont have the prints I made of the mails to hand at the moment.

Date: Thu, 21 Jan 1999 09:00:47 -0600
From: "A. B. Bonds" <ab@vuse.vanderbilt.edu>
Subject: Re: [R-390] Meter Matters

I don't think so. The line level meter is a standard VU meter, which is an AC meter. The carrier level meter is a DC meter.

Date: Thu, 21 Jan 1999 11:07:43 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Meter Matters

There are a FEW meter mechanics in the world, though a dying breed with digital displays, who might change an armature. I've never run into any willing to rewind an armature. My experience has been that most who would attack a meter in more detail than changing the scale have good and bad days and on the bad days there's nothing but scrap produced. I've successfully replaced whole movements, straightened pointers and balanced meters, but not repaired broken pivots, hairsprings, taut bands, or windings.

The last time I approached a good meter mechanic for meter work, it was far less expensive to purchase a replacement movement than hire him to try to repair the broken movement.

As for swapping armatures, there's intimate interaction between armature torque (ampere turns) and spring strength. Lower resistance probably means fewer turns and a more delicate hair spring set.

When installing a paper scale its very important to use a paper that won't yellow and an adhesive such as photo mounting spray that won't accelerate the yellowing.

All which is to say that reproduction meters with special movement resistance may be possible, may almost be practical, but almost sure won't be cheap.

Date: 21 Jan 99 09:23:23 -070
From: "Richard McClung" <richard_mcclung@tcibr.com>
Subject: [R-390] METERS

The best I can come up with:

The Line level meter is: A1A34M101 Ammeter

SM-C-283216 (80063) OLD FSN: 6625-510-1815

The Carrier level meter is: A1A34M102 Voltmeter

SM-C-283217 (80063) OLD FSN: 6625-669-0769
OLD NSN: 6625-00-783-5145

A1 is the receiver assembly A34 is the front panel assembly
M101 is the line level meter M102 is the carrier level meter

The CAGE code 80063 is: US Army Communications and Electronics Material
Rediness Command Fort Monmouth, NJ 07703 Voice Line: 732-532-5332

Someone with the CD (I'm now wishing that I have ordered one last fall) that has all the Signal Corps Drawings and Specifications, could look up the meters and get all the electrical specifications. Then a look through the several meter manufacturer's catalogs should find a suitable electrical replacement. The meter face problem was already solved with the laser printer idea earlier submitted.

Date: Thu, 21 Jan 1999 19:55:42 +0000
From: "Lawrence R. Ware" <lrware@pipeline.com>
Subject: Re: [R-390] Meter Matters

I have (in the far past) replaced pivots, hairsprings and hung replacement taut bands... Not a trivial process. It was far less expensive to purchase a replacement movement than hire him to try to repair >the broken movement. In the early 80's I did a stint working for GE rebuilding/repairing their commercial line of meters as used in large power plants and HV switchboards. These meters were still repaired because new replacements cost an avg. of \$800 each even back then.

Among the special tools/equipment required: A device to *demagnetize* the frames and related metal hardware. A device to increase or decrease the field strength of the PM's used in parts of the units. A set of "keepers" installed between the poles whenever the armature was removed to help prevent permanent change of the field strength. Complete sets of hairsprings, (about 30 different part numbers.) Sapphire replacement pivot assemblies, another 10 part numbers. Complete armature assys, another 40-50 part numbers. Pointers, balance weights, blank scales, (for custom calibration,) NON-magnetic tweezers, micro-screwdrivers, and tensioning tools are all required. And last but not least, the infamous "taut band kit." Two strips of phosphor bronze, two tension setting fixtures and about 1" of special solder... Hanging taut bands required no morning coffee, no air movement, good light, and the patience of Job.... All to often you did it three or four times before the tension was correct. Start to finish, two or three hours was typical before you had a unit that met all factory specs and was ready for return to the customer. GE charged about \$250 each to refurbish those \$800 meters.

>All which is to say that reproduction meters with special movement
>resistance may be possible, may almost be practical, but almost sure
>won't be cheap.

Without all the special tools and fixtures I would not even try.

Date: Thu, 21 Jan 1999 17:34:57 -0800
From: "Tom Roddy" <tcroddy@lightspeed.net>
Subject: Re: [R-390] Meter Matters***WARNING***

>THE TWO METERS ARE NOT ELECTRICALLY IDENTICAL

OK, I got that straightened out! Them meters aren't the same. OK. I shoulda known. Also, are these meters so special that the movements can't be replicated at some Pacific Rim electronics plant? Is it worth the inquiry? I think I'll take the specs that were posted here and send them out to a few of these guys to see what they say.

Date: Thu, 21 Jan 1999 17:49:35 -0800 (PST)
From: john tatman <jtatman@tacomaclick.net>
Subject: [R-390] R-390 meters

The early R-390 manual has this identification for the line level meter:

Meter, audio level: panel mtd; 0 to +3 cw, 0 to -20 ccw, marked VU; sq aluminum, steel, or plastic; 1-27/32" sq mtg fl, 1.510" dia barrel, 1" d to mtg surface; +/-3% accuracy at 0 reading; black self-luminous scale markings and pointer; white background; requires ext multiplier; four .125 holes spaced 1.312" c to c; 2 solder lug term; Collins Rad / dwg No. 481 0001 00.

And this identification for the carrier level meter:

Meter, milliammeter: panel mtd; dc; 0 to 100 cw, graduated in 10 scale division, marked DB; rectangular, steel; 1.510" o/a dia, 1-1/8" body d from mtg surface, excl term; +/- 3% accuracy; self-luminous pointer and scale markings; self-contained; mtd by four .125" dia holes spaced 1.312" c to c; 2 screw stud term; 1/8" lg; Collins Rad part / dwg No. 476 0066 00.

Date: Thu, 21 Jan 1999 18:39:20 -0800
From: "Phil Atchley" <ko6bb@elite.net>
Subject: Re: [R-390] Meter Matters

In past times (a past life?) when I worked at a CB shop I would occasionally be asked to repair a meter for a radio in which a new meter was not available (or trucker needed it "today"). Those are cheap meters, the typical problem is the bearings bind. I was able to adjust maybe 1 out of two to work properly. If I loosened up the "pivot" too much and the armature fell off the bearings, forget it. I always told the customer on the ones I fixed...it's working now but nobody knows for how long!!! :-(

Date: Thu, 21 Jan 1999 19:07:21 -0800
From: "Tom Roddy" <tcroddy@lightspeed.net>
Subject: [R-390] Fw: Meter Repair or Replacment

Here's some info on meter repair that I stumbled upon. And thanks to AB2ET for posting the original. And I remember, THE TWO METERS ARE NOT ELECTRICALLY IDENTICAL.

>Standard Meter Laboratory	These people know a lot about meters
>236 Rickenbacker Circle	in general. They are able to reproduce meters
>Livermore, CA 94550	of just about any style and shape. They can
>	create meter face plates with a CAD program.
>	They have a photographic machine that
>	creates a negative and a method of creating
>	a positive plate that can be inked to make
>	an exact replacement.
>	
>Beede	"will provide info but do not like
>175 South Main St.	the one or two meter deals"
>Penacook, NH 03303	
>800 451-8255	
>	
>Instrument Masters	They will work with you to get the best
>1-973-948-4818	mix for the "repair" A long time in the
>Bud or Dick Ericcson	"trade" a father and son team.
>	
>Ram Meter	
>1903 Barrett	
>Troy, Mich. 48084	
>ph. 810-362-0990	All they do is Meter repair.
>	
>Ye Olde Meter Cellar	
>Leonard W. Cartwright	
>879 Russet Drive	
>Sunnyvale CA 94087	
>(408) 739-6025	

Date: Thu, 21 Jan 1999 21:52:00 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Fw: Meter Repair or Replacment

How about Simpson. They seem to show up regularly. They might still have tooling...

Date: Thu, 21 Jan 1999 23:25:00 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Meter Matters

Good News! We found a highly qualified meter guy! Seems that Larry might need a little encouragement though. ;-) It would be nice if there's some way to adapt (electronically) all those meters that are cosmetically identical (scales excluded- but not a problem). That may have to be a circuit that hangs on the back of them. I

think someone mentioned that approach. The meters I keep looking at are those on the bottom of Pg2 of Fair's WS-98-1 catalog. I'm told they have lot's more of that 1 3/4" style in different values. Also. It was mentioned that one is an ammeter, the other a voltmeter. Isn't an ammeter usually just a voltmeter hooked up across a shunt?

Date: Fri, 22 Jan 1999 00:18:46 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Meter Matters

I seem to have kindled -- or rather rekindled this subject area. BTW, I just remembered what prompted me. Dave at Fair Radio said that as of now, they no longer even have the white-faced meters to sell with their checked R-390A's. This may signal a new low in availability, and an increased base of demand for making replica meters. There otherwise lookalikes I mentioned seem to match up size-wise at 1 3/4" inches square with 1 1/2" barrels.

Date: Thu, 21 Jan 1999 23:30:34 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Meter Matters

Encourage away. My averages with meters is on the low side of 1 out of 4...

I've looked at the 390(a) schematics. The signal meter is hooked between low value cathode resistors on two tubes with opposite polarity voltages applied to their grids, e.g. a bridge meter amplifier. The meter resistance is critical from those low value (<20 and 27 ohms) cathode resistors. The IF tube could stand ten time that resistance with little effect. The AVC tube could too as far as I can tell, so it would be worth the experiment to try to raise those cathode resistors to say 82 ohms to see if a more normal 1 ma meter with about 50 ohms resistance would work.

The audio level meter may be another problem. Typically there's more specifications on damping and sometimes they are rather nonlinear on the scale unless the pole pieces are shaped to correct for that nonlinearity. Otherwise there's a need for a diode bridge and some series resistance. Likely a microammeter would make a better basis than a milliamp meter or and ammeter with the shunt removed. Linearity may be adjusted with diode curve shaping but that's a pain, though far easier than making specially shaped pole pieces. Though a ammeter is often a voltmeter across a shunt, its often a low voltage voltmeter with more than a milliamp of current. Its a lot easier to wind the meter coil with a few turns of #32 than a bunch of turns of #42 (breaking strength about 2 ounces), so when the current can be supplied, the larger wire is chosen. Which means that the shunt has to be adjusted to accommodate the larger meter current, but that's practically trivial.

I didn't see any audio VU meters in the Newark or Allied catalogs I looked through this evening. Just AC and DC. And Simpson 1 ma meters were consistently 47 ohms when their resistance was specified.

Date: Fri, 22 Jan 99 13:42:51 PST

From: "Ronald Reams" <wa4mjf@worldnet.att.net>
Subject: Re: [R-390] Meter Matters

SS of NE has some meters (or did) they're pricey (isn't everything there), but probably cheaper than having custom made.

Date: Fri, 22 Jan 1999 09:04:44 -0600
From: "A. B. Bonds" <ab@vuse.vanderbilt.edu>
Subject: Re: [R-390] Meter Matters

Quite the 'tother way round. A voltmeter is an ammeter with a series resistor. Works like this. Nearly all meter movements (e.g., D'Arsonval) are fairly low resistance (DC, mind you). As such they act as an indicator of series current, on the order of micro- or milliamps. To handle more current, you use an external shunt, and rely on current division. To handle voltage, you use a series resistor, and rely on current limiting. The problem as I understand it with the 390 meters is to have a 1 ma (?) movement with a particular series resistance, which I have conveniently forgotten. If you find a 1 mA movement with less than that resistance, add some series resistance. Since the meter reads current, alles hunky-dory ist. However, a 1 mA meter with more than that resistance requires a parallel shunt to get to the proper load resistance. In this case all of the current will not go through the meter, which nicht so gut ist. Now, the line level meter is a VU meter. This is indeed a voltmeter, but it is an AC voltmeter. It will have at its core a DC meter movement, but will also have a meter rectifier (usually copper oxide, so there is no voltage offset as found with sand-state stuff) and probably a series calibrating resistor as well. VU meters are made to an industry spec (0 VU is something like 1 mW across 600 ohms, or 0.775 v). They also have a carefully designed ballistic to "integrate" the changes in volume. I'll bet that VU meters are still being made, they are used on mixing boards and the like.

Date: Fri, 22 Jan 1999 09:13:18 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Meter Matters

The 500-0-500 microamp meters are 1 ma with an offset zero. If their resistance isn't too wild they might be easy to modify, to the point of just using the electrical zero at an extreme position.

Date: Fri, 22 Jan 1999 17:27:08 +0100
From: Rolf-Lutz@t-online.de (Rolf Lutz)
Subject: [R-390] R390A Meters

In HSN 22 Page 2 is a specification of those 2 meters. The R390A line meter is 250 μ amps full scale, 3360 ohms internal resistance The R 390A carrier meter is 1 mA full scale 17,7 ohm internal resistance. Even a small error (high or low) in the external resistance of a carrier meter will cause rather large errors in carrier meter readings (Dalles Lankford) Spring 1980

Date: Wed, 03 Feb 1999 19:59:45 -0600

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

If the meter is sticking above the mechanical zero, it can be a defect in the bearings, a steel filing obstructing the movement, dirt or static electricity. Try tapping the panel to see if it goes on down. That would indicate a sticky bearing.

If that doesn't work, try wiping the meter glass with pure dish washing detergent. Its conductive enough to remove static charge that can cause a meter to not zero. That shows up most often around compulsive cleaners. An antistatic spray should also be effective. Don't wipe the meter face clean if its a static charge that's the problem.

I don't think there's a mechanical zero available front or back. In the audio meter there's sure no way electrically to get it go to zero if it doesn't do it mechanically with power off.

Date: Mon, 8 Feb 1999 21:18:16 EST
From: DCrespy@aol.com
Subject: [R-390] Meters, been there - done that

You know, I have tried a number of the meter solutions.. including modifying the international brand 1mA meters internally (which, while it works nicely, exposed me to any radioactive particles that might have been 'freed' by the process). In the end, all of the searching and other efforts have produced a box full of 'almost right' meters.

I have three radios. One radio has meters that are close (including the one international one above) and they look good and work nicely. The other two have original meters. I am SURE that I spent as much money collecting approximations and trying to cobble up a non-stock solution as I did just finding and buying the right meters for the other two. (Not to mention the potential health hazard..??)

I'd recommend posting a request to the list or just contacting one of the suppliers to the hobby (like Fair Radio or Surplus Sales of Nebr. or one of the individuals that might have parts.. like Dave Medley, John Bess or Chuck Rippel..). Mac McCollough sold (sold out) a lot of meter sets last year and I am sure there are some unused ones out there on the list...

In the end, I think you will appreciate the finished radio more. And you can spend your valuable time getting the best possible performance out of these great old sets!!

Date: Mon, 8 Feb 1999 20:03:22 -0000
From: "iasckids" <iasckids@pacbell.net>
Subject: [R-390] Meters

Well I think Harry said it well. Speaking as one who spent a long three weeks trying every one I could think of on the subject of replacement meters for the R390A , I

must confess to finally succumbing to the dreaded "GOTTA GET THEM D---
METERITIS" and subsequently witnessed the darkening of the sun over Nebraska
by a flock of 182.00\$ bills ,all so my R390A might have the correct meters. The
phone bill and investigative time spent do not warrant(so far) not just getting the
right meters in the first place. While I balked at the price, Surplus Sales of Nebraska
did come through with a timely delivery of a quality product. They did solve that
problem for me when no one else could. The rx works like the day it was
made,however I do believe that a full detailing by Chuck Rippel would be money
well spent.

Date: Mon, 8 Feb 1999 23:22:52 EST
From: Nv4t@aol.com
Subject: Re: [R-390] Meters, been there - done that

Harry, the hazard occurs ONLY in very old meters with radium painted dials. Most
modern meters don't contain any radioactive substance. Go ahead and modify
them to your hearts content!!!!

Date: Tue, 9 Feb 1999 08:22:56 -0800
From: "Tom Roddy" <tcroddy@lightspeed.net>
Subject: [R-390] Meter Matters

A while ago I posted an inquiry regarding the custom manufacture of replacement
meters for the R-390A. Thanks to Craig, I'll soon have drawings to send off to three
Asian manufacturers. One Japanese, one Taiwanese, and one Hong Kong(ese?).
Just worked out like that. Then they can get back to me with prices. Instead of
trying to post and ask who wants how many, I'll
just make up an number (200 each?), get a price and then post. I would buy three
sets, as I have two radios with original meters.

Instead of asking the "exact replacement" meters be made, I'm asking for
electrically exact replacements that look more like contemporary panel meters.
Clear plastic fronts with relatively large and readable scales. I just find those little
unlighted black things hard to read (and can always put them back on when the
purity cops stop by). Maybe even lighted. I have
already received one set of catalogs that has some very nice looking meters. I can
post a little scan if you folks want, and the rules allow it.

Interestingly, I found one factory that makes only the 'movements' for meters, and
am not sure how to fit him into this. Any ideas on this?

I don't know what the cost will be and will have to have that before I know if this is a
good idea. I hope something comes of this and thanks for your help. Also, I "just
happen" to be going to Van Nuys tomorrow and will stop in at All Electronics to pick
up a few of their meters you guys talked about.

Date: Tue, 09 Feb 1999 11:31:57 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Cheap Meters for R-390

The problem in the s-meter circuit is low voltage which means the original 1 ma meter has a resistance much lower than normal. Low current and low cost meters tend to need more horsepower to move the pointer and so have a greater resistance to get more voltage for the current. The low value cathode resistors may need to be increased as much as a factor of ten to get enough voltage to drive the meter.

Date: Tue, 9 Feb 1999 10:02:36 -0800
From: "Phil Atchley" <ko6bb@elite.net>
Subject: Re: [R-390] Cheap Meters for R-390

Not to argue, but the meters I mentioned are 250uA so possibly have greater sensitivity. It is worth a try for the people needing one is all I said. And yes it is possible the resistors may need a slight "value change, but that is a far less drastic circuit change than some people suggested awhile back with perfboard "op-amp" circuits on the back of the meters.

Not needing any I can't try it out but thought it might help somebody who is desperate for meters and not able to pay ~170 or so.

Incidentally at the present time I'm using a SS rig (Drake TR-7) with which I'm very pleased (it's a much needed transceiver) but hope to get into the BA game again with a R-390A or SP600, maybe a HQ180 or so ;-)

Date: Tue, 09 Feb 1999 13:43:34 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Cheap Meters for R-390

Yes, greater current sensitivity. But poorer voltage sensitivity. The normal 1 ma meter takes about 50 millivolts full scale (50 ohms resistance). The typical 1/4 ma meter may do as well, though the knock off makers tend to be higher in resistance. That 1/4 ma meter will likely have a resistance of 200 ohms to still take 50 millivolts, though I'd not be surprised that its resistance was 500 or 1000 ohms to need 125 or 250 millivolts which the 390 s-meter circuit will not provide. The original 390 meter (which has its own mil spec from being used in a multitude of equipment apparantly) has a specified resistance of 17 ohms which means its 17 millivolts full scale. A 250 millivolt meter won't deflect much at 17 millivolts full scale. Probably the 68 ohm resistors in the meter circuit (there's something like that across the meter adjust pot and a fixed on to ground on the other side of the meter) will have to rise to 270 or 330 ohms to get full scale deflection with a 50 millivolt meter.

Date: Tue, 9 Feb 1999 14:20:20 -0800 (PST)
From: Stanley Wilson <microres@crl.com>
Subject: Re: [R-390] Cheap Meters for R-390

Hey fellows remember Ohm's law. Also the meter works on current in one circuit and voltage in the other in the R-390A. Now for the S-meter which someone said is 1 ma meter, then you will have to parallel the meter with a resistor to use the 250 μ a

meter. Take a 1.5 volt battery and a large resistor (about 6 k I think) in series and adjust the resistor for full scale reading on the meter that is 250 micro amps. now use a parallel resistor and trim the parallel resistor until the meter reads 1/4 scale. You now have a 1 ma meter.

Use a piece of copper wire about 22 or 24 ga to make your parallel resistor. I would start with about 6 ft. trim length of the wire until you get 1/4 scale reading with the battery and series resistor combo.

Now the line meter is different. You need to make up a diode bridge and then use a series resistor after the bridge. Not sure what the voltage is but remember the meter is micro amps and assume you have one volt out of the bridge then you will need $r = 1.0/.000250$ for full scale reading.

DO NOT TRY TO READ THE VALUE OF THE METER RESISTANCE WITH AN OHMMETER

Date: Tue, 09 Feb 1999 17:10:04 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Cheap Meters for R-390

Its going to take a LOT of 22 gauge copper wire to make that shunt! About 75 ohms of it if the 250 microamp meter is typical at 200 ohm resistance. More if its higher from being a cheap meter. The line meter will be more logarithmic if the diodes are right at the meter and the series resistor is on the AC side.

Date: Tue, 9 Feb 1999 19:02:50 -0800
From: "Phil Atchley" <ko6bb@elite.net>
Subject: [R-390] Meter Substituion Experiments

Hello, back to the serious side, substitution of meters. At the present moment I'm R-390A-less and I loaned my "downloaded" schematics to a friend so this is purely from memory. May require a little scrutinizing of the schematic. But this method should work with perhaps slight modification.

First, the carrier meter is across the cathodes of two tubes, we all know that. If I recall correctly though (correct me if I'm wrong) it is only across part of the cathode resistance. Here is what I propose. It will require one R-390A receiver with a known "good" carrier meter for reference. (or borrow a meter from another set to temperally check out the "patient".

The following sounds like a lot of work but really not everyone should need to do all this. Once one or two are done "post" the results/resistor values for the rest. I'm sure that if the preliminary work is done on known good sets the parts values will fall in line for the rest of em. (They do for the present stock units)

EXAMPLE:

1. Make sure the meter is "zero-d" with no signal. Tune in the calibrator at a

"reference" frequency, say 10MHz, peak the antenna trimmer and make note of the reading, we'll say 70dB for the purpose of this example.

2. Remove the "reference" meter. Measure the total resistance of the two cathodes to ground. Don't recall the value now but say it is 250 Ohms. Remove all resistors (and pot) from the cathodes of the two tubes. Connect two "pots" of same value 250 Ohms (or 500 Ohms with a 470 Ohm resistor in Par) from cathode to ground, leaving the two "slider" connections unhooked. Now connect the two leads of the new "test" meter to the two slider connections.

NOTE: This will have to be done with long enough leads to allow temp re-installation of the IF module.

3. Re-install the module, power up the receiver with same settings as you calibrated with. First adjust the two sliders for "zero balance" with no signal. Then turn calibrator on and adjust "both" pots for a reading of "7" (remember the 70dB above) on the meter. You're actual reading will of course be different. If meter reads backwards reverse the meter leads.

4. You will probably have to "balance zero" and adjust "level" several times as there will be interaction.

5. Remove power and IF Module, being careful NOT to change pot settings. Disconnect the "test" meter" Measure the resistance in the two legs of ONE of the pots. Remove that pot and replace it with two "fixed" resistors of the correct or closest value. (5% resistors should be close enough) Install the "other" pot where the original "carrier" pot was and mount/rewire the new meter.

6. Re-install the IF chassis and "zero" the new pot after warmup.

7. Enjoy your R-390A with it's nice new meter.....

Date: Wed, 10 Feb 1999 21:10:27 +0000
From: "Cal Eustaquio" <n6kyr@value.net>
Subject: [R-390] Cheap meters

Got them...yuk! Wasn't what I expected. Oh well. Eighteen bucks down the tubes. But no sweat. I can use them for other stuff. Don't expect to get mil style meters with ALL Elec. Not your fault, Phil. But I did take chance. Still, it will do until you can afford better meters. Cal,

Date: Wed, 10 Feb 1999 21:59:41 -0800
From: "Tom Roddy" <tcroddy@lightspeed.net>
Subject: Re: [R-390] Cheap meters

I picked up a few of these at ALL Electronics today. You are right in that they are not mil-spec. But for \$1.50 each, not bad. For those contemplating buying these for entertainment, let me relate my experience tonight:

There are no mounting screws, so I guess one is to glue or duct tape them to the front of his radio. Also, the movement well appears to be a bit low, and I suspect that the meter body may not cover the 1-3/8" hole completely once it's duct taped in place. Two small solder tabs are provided for connection. A small label on the back says "Made in Taiwan".

Notes on disassembly of these things:

This is a typical clear plastic meter with a black bezel fitted over the front. The bezel is attached with a bit of double sided tape (what else?) to the meter body. This piece of tape is right below the meter window, so you can't get to it directly. Carefully prying the bezel forward with a finger nail, along with some gentle heat (hair dryer) and pressure application, the bezel eventually pops off. I'm really surprised I didn't break the thin black plastic doing this.

Once the bezel is removed, one sees that the clear front of the meter is taped (what else?) to the back of the body with three small bits of clear tape. At least it isn't glued. Once opened, the meter face appears to be atomically welded to the meter back, but I have yet to try to pry it off. Could be another piece of double stick tape.

It appears that the meter face could be replaced by just gluing another over the existing face. Also, lighting this meter would be easy with grain of wheat lamps.

Mil-spec? Hardly! Worth \$1.50 + tax? Definitely. Before you buy any and if you have any questions, let me know.

Date: Tue, 02 Mar 1999 00:28:00 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] More meter matters

>We all prefer "original" meters -- I think. But what is truly original?

My 1967 Contract EAC has a large windowed meter and a medium windowed meter. The line level meter has a number of 59.7290 in the lower right corner and the carrier level meter has the number 59.7289. As to who made them, I have no idea. But, they are original to this receiver and dated to it and each other. Actually, the large faced line level meters have a rather distinctive looking face. I can spot one across a room or even on a fuzzy jpeg on a website.

My 1955 contract Collins ate a meter about twenty years ago and I replaced it with one from spares. It's on one of the benches in another part of the shop. I think that it currently has a GVS one and a Simpson one of I remember right. I think both of these use the painted sheetmetal covers with a paper liner. I think that the Simpson was the replacement that I installed. It's been a long time and it didn't seem important so I didn't really pay it much attention, so I may be wrong on this and the GVS was the one I installed. If anyone has the original meters in their Collins, I'd like to know what they are so I can install the correct one.

>have just come across three black metal audio and carrier level meters
>which all look alike at first glance, but: Among other things, the bezels
>are not the same thickness.

I guess that I've had a total of a couple of dozen sets of meters pass thru my hands thru the years, both in the receivers and as loose spares. There were lots of variations. Some used a thin rubber gasket, some used a quarter inch thick rubber spacer like the small windowed International brand ones with a hollowed meter bezel.

>The thinnest one is an audio meter that is 3/16" thick. I have a carrier meter that's 5/16's and >another that's 3/8" -- twice as thick as the thinnest.

Yep. Some are also a bit less than the inch and three quarters square and used sheetmetal covers that covered the face and the size too. If the size of the meter housing of the "thin" one is smaller than the others, it may have originally used a sheetmetal cover.

>Only the two thicker ones have phosphorescent pointers and dial markings.

Every original meter that I have or have had was phosphorescent. Naturally, as they get older, they aren't as bright. One of my spares has a bluish purple glow rather than the greenish glow. I don't remember which brand it is, but it's the only one of that color that I've ever seen. If anyone's actually interested, I'd grab a maglite to charge them and root around and see.

>The middle one must be a replacement as it says "Dejur" on the face.

Dejur is a legit meter. Been there, done that. I don't remember which contract receiver they came in but I had a pair of them that picked up in the 1970's, long before the fake/repo meters were even a gleam in someones eye.

>Were there variations in the originals as they were first installed over the >years?

Yes. I've seen at least two different style International brand ones as an example. One that had a solid cast aluminum face and one with a smaller face that used the stamped cover. I'm pretty sure that there were a couple of variations of the Simpson too, even though they were the same model number.

>Obviously there were replacements that varied as meters were
>changed out by the military. Now, from Gene, we learn of a
>white-faced one rescued from a destiny with the deep.

I've yet to see one of the white faced ones. If the Govt started using them it must have been later than the mid 1970's. Hundreds of surplus 390's were pawed over by me back then and I'd have remembered something as odd as a white faced meter on one.

>I've got some white faced 1 ma Roller Smith brand meters that I picked up

somewhere a >while back but I don't think that they were originally for the R390A.

If someone has a white faced "Govt" one, I'd appreciate it if they'd post a description of it and the markings. Barry, if you get a chance, email me a complete description of the meters that you have, both the spares and the ones in your receivers. Actually I'd be curious to hear from anyone that's got an original radio as to the contract number of the receiver and which meters is equipped with. Speaking of R390A meters, I need several of the left hand thread hollow screws/bushings that hold the mid 1960's version of the International branded meter housing to the bezel. The International ones out of the 1950's used right hand threaded ones. ;-) A dead water filled International with a broken lens is fine if someone has one, all I need is the bushings, IF they're lefthand thread! thanks, nolan

Date: Tue, 2 Mar 1999 07:38:44 -0600
From: pbigelow@us.ibm.com
Subject: Re: [R-390] More meter matters

I believe the mismatched "window" size of the meters is correct for a 1967 EAC. Mine is equipped that way, also. The "Line Level" has the large face allowing viewing of the movement and the "Carrier Level" has the smaller face. In a conversation with Rick Mish a couple of years ago he indicated that those were the correct meters for the '67 EAC.

Date: Tue, 2 Mar 1999 12:29:12 -0400
From: "Chuck Rippel" <crippel@erols.com>
Subject: Re: [R-390] More meter matters

The large ones are made by QVS and the best (most attractive to me, anyway) carrier meters are 181's by Simpson.

Date: Wed, 03 Mar 1999 13:28:49 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] More meter matters

>I believe the mismatched "window" size of the meters is correct for <snip>

Yes, they're correct for that contract. The receiver is in the rack the covers screwed down so I can't get the exact markings off of the back of them, but they're both inkstamped with the same 1968 date if I remember right.

>In a conversation with Rick Mish a couple of years ago he indicated that
>those were the correct meters for the '67 EAC.

It still seems strange that they'd have used two different sized openings like that though. :-)

Date: Wed, 03 Mar 1999 14:05:07 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] More meter matters

>The large ones are made by QVS and the best....

I'm guessing then that QVS (I thought it was GVS, I'm slipping) must have build both of the meters for the '67 EAC's then, correct?

>(most attractive to me, anyway) carrier meters are 181's by Simpson.

Yep, with the sheetmetal cover. :-) Got one in my '55 Collins. It's got an "uncluttered" look.

>1968 Contract Dittmore-Friemuth R390A #38

What does the DF use for meters?

Date: Wed, 03 Mar 1999 12:22:01 -0800
From: David Ross <ross@hypertools.com>
Subject: [R-390] meters for sale

I have some meters which were removed from scrapped PRC-47 military radio sets. They are an exact mechanical fit in all the R-39X radio front panels. These have a 50 microamp movement and probably have an internal resistance different from the original R-39X. These meters have a cast bezel, not the stamped sheet metal cover piece like some R-39X meters. The original bezel finish is a very durable semigloss black paint, but may have some OD paint overspray on it. I'll include used mounting hardware until it runs out. All the meters have the same scale - 8 graduated divisions plus a white 'normal operation' area around 2/3 scale. The scale is silkscreened white on a black background. I've seen several different manufacturers, but most of these are made by DeJur. I'll test the meters for basic functionality, and match them for bezel & scale cosmetics and manufacturer, and ship a pair of them to you (postpaid CONUS) for \$15.

Date: Wed, 03 Mar 1999 17:51:50 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] More meter matters

Since the meters have their own military specification not unique to the R-390 and the details of the covers are not in that specification, they are likely to come from different vendors for different production runs. Likely they were also used in other radios of the day like aircraft radios, and there may be even more sources and variations than just seen in the assorted 390 contracts. With them being mil specifications, not Collins part numbers, the radio building contractor has to take what ever fit the mil spec at the best price whether they matched or not. Probably didn't always complete a contract with the same appearance meters as began the contract. <snip>

Subject: R390 Meter recap Tue Jan 02 09:57:45 1996

I got a couple of messages asking what R-390 meter removal had to do with safety.

Here's a recap for new list subscribers who weren't around when we beat the subject to death a year or so back. :-) Maybe it's time to redo this anyway, as some of the new folks might unknowingly encounter the hazardous stuff out there. It seems that in the early 1950's military gear specs often called for the ability to operate the equipment in total or near total darkness. To that end, meter movements often had their calibrations and needles painted with materials that glowed in the dark, like old fashioned alarm clock dials did. The clocks were done with radium doped paint. I hesitate to say that the meters were done the same way, but some of them show definite emission of ionizing radiation; i.e., they're low level radioactive.

Because of the radioactivity, the meter movements were removed from some sets prior to the release of the radios to the surplus market. Presumably, the removed meters went to a radioactive waste dump somewhere. It now seems that these meters are no longer being pulled. The hot meters are MOSTLY (but not all, by any means!) hermetically sealed units, and are probably perfectly safe if the seals remain intact, and the operator is a reasonable distance away from them. If the beast is sealed and the glass is intact I'd have no problem with having them in my shack. Some of the units known to have this sort of meter (usually, but not always) are R-390, R-390A, R-389, R-391, R-392, T-195, and many of the VHF FM military sets. The movements are usually square, about 1.5" x 1.5" . There is usually no radiation hazard marking or sticker on the meter case; I've yet to see one. Checking to see if the meter you've got glows in the dark is not a reliable test to tell if you've got a hot one. Some of these were pretty dim to begin with, and they've lost light emission efficiency over the years. The easiest to tell for sure is with a Geiger counter.

For me, the rule of thumb is that ANY sealed meter is suspect until proven otherwise.

That's the good news. Now, here's the bad news. During World War 2 a number of military radios got the same glow in the dark treatment, but in places where the paint wasn't sealed from exposure, wear and flaking. In addition, some of them were treated with paints that were REALLY hot as compared to their Cold War brethren. These things probably can and do release radioactive dust that can be accidentally inhaled or swallowed. It was in panel markings, on knobs, on switch levers, etc. In addition, the stuff was used on UNSEALED meter movements!

These things ARE NOT welcome in my shack under ANY circumstances! Two of the worst offenders are the TBY transceiver (low band VHF backpack, US Marine Corps issue), and the TBX transceiver (HF field set, USMC issue. Too bad, this is a really neat radio). Highly suspect is the meter movement in the APR-4 and APR-4Y electronic countermeasures receiver (38 - 4000 MHz with appropriate plug-in tuning heads). Bear in mind that this list is NOT all inclusive. A more complete list of hot radios (and even that's not complete) is in a back issue of ELECTRIC RADIO. I don't mean to scare anyone, but forewarned is forearmed. 73's, Tom, K9TA

Subject: R390 Meters -- radioactive labeling Sat Jan 07 11:56:48 1995

One short note: The reconditioned (like new) R-390 that I recently purchased from Fair came with meters, covers, spare tubes ... the works. And it must have sensitivity in the tenths of a microvolt -- cause it out performs everything I have. BUT ... the meters were labeled as follows:

V Radioactive Material

| Controlled Disposal Required

1 micro Curie Ra226 or less

So ... from all that has been posted here, plus the above, as long as the meters are intact, everything is okay. Isn't that about where we are on this subject?

Date: Mon, 02 Aug 1999 14:45:33 -0500

From: Nolan Lee <nlee@gs.verio.net>

Subject: [R-390] substitute meters...

Jan and I were discussing the calibration of an op-amp module that he built to drive the readily available and inexpensive 1 ma meters that have internal resistance values too high to normally us in an R-390A. Can any of you make the following measurments of original R-390A carrier level meters and supply the test values as outlined in the following part of my message to him? <snip>-----

Actually, calibrating it wouldn't be difficult. All you'd have to do is slowly increase the voltage across an original or two and see what they are at full scale. Then measure the input voltage to the SS gadget and calibrate the output accordingly for the meter that you're using. Nothing to it. Naturally, do to the low internal resistance of the original meters and their fragile nature, you'd want to limit the voltage across them when measuring to keep from frying them. Probably a 1.5 volt "N" cell battery and a ten turn 10K pot would do the trick. Hold on a sec.... OK, it only took about ten minutes to set up and measure. I didn't have a 10 K ten turn pot handy so I used a 1K one with a resistor sub box and a standard 100 ohm pot in series to determine the FS and 1/2 scale voltage requirements. I need to get an actual resistance decade box one day. ;-(I took a NOS Simpson 182 carrier level meter out of it's box that I've been setting on for twenty years as the test subject. It's stamped as being made on Sept 27th of 1960. The mechanical zero of the meter is perfect as viewed thru a 16x eye loupe when the face is perpendicular to the floor. for what it's worth, it doesn't glow worth a damn any more. It did 20 years ago. ;-(

OK, I measured the resistance of the meter first. I slightly loosened each of the two nuts on the back and then re-snugged them to make sure that they were making good contact to the treaded posts and the solder eyes. After subtracting the resistance of the test leads, the meter movement itself, when measured from the center of the two tinned solder eyes, is 17.89 ohms. The voltage measured across the two solder terminal eyes on the rear of the meter for precisely full scale deflection as viewed thru the 16x loupe with the tip of the pointer centered over the graduation for 100 db was .01692 volts. The voltage for midscale deflection to the center of the graduation for 50 db was .00879 volts. Hmmm, I see a .00066 volt

error on the part of the meter movement. Cheap piece of crap...<grin> Those are some really low voltage levels. OK, that'll give you a good idea for adjusting the output levels of the SS gadget for the FS input voltage. - -----<snip>-----

Date: Thu, 12 Aug 1999 20:36:58 -0500
From: "A.B. Bonds" <ab@vuse.vanderbilt.edu>
Subject: Re: [R-390] zeroing meters...

The meters should be mechanically at zero for proper operation. Unfortunately, none that I have ever seen have an external adjustment--sealed, y'know. However, some of them can be disassembled. I have some "International" labelled meters on my sets that permit mechanical zeroing. By removing the meter, one sees on the back of the frame a thick rubber gasket. Gently pry out the gasket and you will find fittings that permit the case to be disassembled. Once free of enshroudment, the spring arms (either front or back) can be rotated by pushing with a very small screwdriver until zero is achieved. Note, of course, that by unsealing the meters you are exposing yourself directly to the vicious radioactivity, so this procedure cannot be recommended. Officially.

Date: Thu, 12 Aug 1999 23:13:41 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] R-390A Line Level Meter FAQ...

After I cross posted my message to Jan on the Carrier Level meter full and partial scale voltage readings, I received a number of requests for similar information on the Line Level meters. I have a few extra minutes, so I'll hammer out a quickie FAQ on the R-390A line level meters. If I have time, I'll do one on the Carrier Level meter. If you spot an error, holler back and I'll correct it and re-post. - -----<snip>-----

Nolan's R-390A/URR Line Level Meter mini-FAQ
Revision 0.1 BETA (8/12/99)
nlee@gs.verio.net

The line level meter for the R-390A is an AC meter with an internal resistance of 3900 ohms, plus or minus five percent at 1000 Hz. It's designed to be used with an external 3600 ohm, plus or minus one half of a percent tolerance, resistor giving a total circuit resistance of 7500 ohms. The meter housing is a standard one and three quarter inch square meter using four one eighth inch diameter mounting holes arranged in a one and five sixteenths inch square pattern.

This meter uses a standard "A scale" graduated meter face with the VU (100 on lower scale) graduation indicating 1 milliwatt into a 600 ohm load. In the event you ever wondered what VU actually stands for, it's "volume units". If you want to check the calibration of one of the meters, odds are that you won't have the precision 3600 ohm resistor, but a carbon composition 5K linear pot adjusted to exactly 3600 ohms in series with the meter will work just fine. Optimum calibration is listed below. You'll need a stable audio signal generator set to 1000 Hz that has an adjustable output and a sensitive high input impedance RMS voltmeter that is accurate for measuring a 1000 Hz sine wave.

Make damn sure that you pay attention to the output control and set it to zero before you power it up to prevent smoking the meter. Also, as you advance the control to increase the voltage output, do it real slow to prevent slamming the meter movement or smoking it. If you're not sure of what you're doing, leave the meter alone. You won't damage it that way. ;-(

The meter and the pot, set to 3600 ohms, are wired in series with the output of the audio signal generator. Polarity is unimportant. The RMS voltmeter is used to measure the output of the signal generator directly from the output terminals and is used to measure the voltage across the meter/pot combination.

Here's what you should see for a perfectly calibrated meter:

- -22 VU (0 on the lower scale) should be 0.000 volts RMS
- 25 on the lower scale should be 0.307 volts RMS
- 50 on the lower scale should be 0.614 volts RMS
- 4 VU should be 0.775 volts RMS
- 3 VU should be 0.869 volts RMS
- 75 on the lower scale should be 0.921 volts RMS
- 2 VU should be 0.975 volts RMS
- 1 VU should be 1.095 volts RMS
- 0 VU (100 on the lower scale) should be 1.228 volts RMS
- +1 VU should be 1.378 volts RMS
- +2 VU should be 1.546 volts RMS
- +3 VU should be 1.735 volts RMS

Date: Sat, 19 Feb 2000 23:31:37 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] R390A Meters

Yes, I've had meters repaired. Most often the meter shop would rather replace the movement than repair it. A few hours ago, I straightened a bent pointer on my best Simpson 260 that came from the movement mounting nuts working loose. Guess I shouldn't have laid on that corn dryer plenum last year. I've changed scales on several meters and I've destroyed several trying to fix them. So I won't offer my services. I've fixed the movement in a junked out Weston clamp on ammeter good enough it was calibratable in a good meter shop. A couple times. Dropping it off the top of a corn bin wasn't GOOD for the movement but I was able to recenter the slug in the middle. I did fix a bad solder connection on a surface mount transistor to make my CD-R work again this evening also. R-390 meters with their radioactive scales and pointer and their hermetic seal are a lot harder to work on.

Working on meters is like working on women's wrist watches. Few ever could and those that could are getting old and shaky...

Date: Fri, 21 Jul 2000 18:31:35 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Use of non-standard carrier level meters

Since the carrier level meter is a bridge circuit with two tubes up top and two resistors to ground with the meter between the two tube cathodes (very much like that in VTVM's) I figure that by changing the two resistors to ground by the same ratio as the difference in meter resistance that the results will be quite similar. E.g. in the R390 schematic I just looked at, the AGC tube has a 27 ohm resistor to ground and the zero adjust pot is in the IF tube cathode and is 15 ohms. The original meter is 17 ohms 1 ma. A better meter would have been 50 ohms 1 ma (three times the horsepower, so more rugged). 50 ohms is a common resistance for a 1 ma meter. So I'd try a 91 ohm resistor on the AGC tube and a 50 ohm zero pot. I think it will work just fine. I'm talking about changing voltages around the meter in small amounts. The meter drop changes from 17 to 50 millivolts... Not enough to upset any tube.

Last I remember looking at the R390A schematic the resistor values around the meter were similar. If the meter calibration wasn't quite the same not necessarily quite log curve, one could easily make a new calibration with the help of a calibrated signal generator.

Date: Sat, 21 Oct 2000 23:03:28 -0700
From: "William L. Turini" <Turini@hamanuals.com>
Subject: [R-390] Radioactive Meter Repair

I noticed that the line level meter on the '67 EAC I bought last weekend is not resting on zero. Other than that, it seems to work ok, i.e. it moves like it should, just doesn't come to rest on zero. I did not notice a zero adjust on it. Can anything be done to correct this? Will any of the commercial meter repair firms work on such deadly equipment ?

Date: Sun, 22 Oct 2000 03:06:42 -0400
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] Radioactive Meter Repair

I believe most of these meters do have the zero adjust screw -- but on the inside of the "containment" which protects you against the nuclear winter that lurks inside. Even if the meter is opened, the levels are not sufficient to cause radiation sickness and death within three days. It may be possible to carefully open the thing, make the adjustment, close it up, wash everything down and dispose of the disposables somehow. Or, you may want to just live with it. Seriously though, how far off is the needle? Is the front cover metal or phenolic-bakelite? A slight off-zero might not mean much in terms of accuracy where the spring tension through the range is more influential as well as the bridge circuit that drives it. I ask about the cover because I've seen large meters develop static "stiction" after a trip wrapped in plastic and styrofoam. The static charge causes the needle to be attracted/repelled from parts of the case or window. This should be less likely if the meter has a metal front which is grounded via the mounting screws to the front panel. What I've done is to ground the meter face to drain the static - or ground myself and hold my hand over the face for a few seconds. Of course, it might not be that at all.

Date: Sat, 18 Nov 2000 16:09:06 -0500
From: "Roger Gibboni" <gibboni@attglobal.net>
Subject: [R-390] Re: carrier meter level adj

Have an Imperial 390a, works great. Just checked sensitivity and it seems better than spec., however the carrier level meter appears to be insensitive. Went thru adj procedure, but can't get a full scale deflection and its practically useless on the air. Any ideas?-

Date: Sat, 18 Nov 2000 14:57:33 -0500
From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: [R-390] Re: carrier meter level adj

Probably something as simple as a bad cap or out-of-spec resistor, Roger. I'm not at all up on the circuitry, and I, too, have an Imperial/Teledyne rig here. Mine looks new, but needs work as it only works on the BC band(will I *ever* get back to it? Stay tuned...). There are *many* on this list who know these rigs inside out, however, and I'll bet this issue has popped up before. Stay tuned, I'm sure you'll get some very good replies.

Date: Sat, 18 Nov 2000 14:55:43 -0800 (PST)
From: Tom Marcotte <courir26@yahoo.com>
Subject: Re: [R-390] Re: carrier meter level adj

My first reaction is that the rig needs alignment. If the rig is aligned properly and you get a decent diode load voltage with a strong signal, then check resistor R548 in the IF module. This resistor has influence upon the full scale reading.

Date: Sat, 18 Nov 2000 16:15:44 -0800
From: jan@skirrow.org
Subject: Re: [R-390] Re: carrier meter level adj

First question I'd ask is whether the meter is an original, or a look-alike? If it's an original then it should be lively assuming the zeroing pot works right. If it's a look-alike, then it probably isn't the right internal resistance (the R-390A meter is unusual) and probably won't be lively or reach FS. This issue has been thrashed to death on the list.

My website has a piece on a little amp to allow use of look-alikes w/o modifying the R-390A circuitry. Also, I do have Bristol wrenches for the R-390A. They are \$3 for one, \$5 for two - shipping anywhere included. If you only need the one for the R-390A this isn't a bad deal. If you need other sizes as well, better to buy a set (which I don't sell).

Date: Sun, 19 Nov 2000 10:57:56 -0500
From: "Roger Gibboni" <gibboni@attglobal.net>
Subject: Re: [R-390] Bristo Wrench

Thanks- I found the page for "bristol" wrenches, I think they're the ones but I can't tie

your part numbers to theirs- any help? PS: The meter appears to be a replacement- not radioactive but the range worked fine when I first got the rig- so the impedance must be close enough I'm gonna have to pull that IF module and check the cathode resistor.

Date: Sun, 19 Nov 2000 12:01:34 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] Bristo Wrench and Carrier Meter Resistance

Yep, I've had one of mine for twenty five years. It's about a half an inch shorter than it originally was. Something that you guys that use the bristol and Allen wrenches need to keep an eye on is wear. After a while, the end of the wrench will wear and start to round. If you use a wrench like this on a really tight fastener, you run the risk of it slipping and stripping the head of the fastener. I use a bench grinder with a fine wheel to grind back the end of the wrench and then lightly hit in on a "soft" wire wheel.

Someone gave me a set of Allen wrenches a while back that had a "ball" on one end to allow you to use the wrench at angles other than perpendicular to the head of the fastener. After ruining a set screw and then having to anneal it and drill it out, I cut the "balls" off of that set of wrenches.

>Meters are 17 Ohms if I recall right.

Yep, here's a snip from a post I did on the subject back in mid 1999 that covers the resistance and voltage requirements for full and mid scale readings: - ----
<snip>---- I took a NOS Simpson 182 carrier level meter out of it's box that I've been setting on for twenty years as the test subject. It's stamped as being made on Sept 27th of 1960. The mechanical zero of the meter is perfect as viewed thru a 16x eye loupe when the face is perpendicular to the floor. for what it's worth, it doesn't glow worth a damn any more. It did 20 years ago. ;-(OK, I measured the resistance of the meter first. I slightly loosened each of the two nuts on the back and then re-snugged them to make sure that they were making good contact to the treaded posts and the solder eyes. After subtracting the resistance of the test leads, the meter movement itself, when measured from the center of the two tinned solder eyes, is 17.89 ohms. The voltage measured across the two solder terminal eyes on the rear of the meter for precisely full scale deflection as viewed thru the 16x loupe with the tip of the pointer centered over the graduation for 100 db was .01692 volts. The voltage for midscale deflection to the center of the graduation for 50 db was .00879 volts. Hmmm, I see a .00066 volt error on the part of the meter movement. Cheap piece of crap...<grin> Those are some really low voltage levels.-<snip>--

Date: Sun, 19 Nov 2000 16:48:30 -0500
From: "AI2Q Alex" <ai2q@ispchannel.com>
Subject: RE: [R-390] Re: carrier meter level adj

Although it's difficult to "DX troubleshoot," I'll offer a thought or two for you that might help. If you study the block diagram, and then the schematic, you'll notice that the IF signal at the output of IF transformer T502 splits. One path feeds the grid of the 4th

IF amplifier V504--and then the detector, limiter, etc. The other signal route goes to the grid of cathode follower V509. The low-impedance output signal at the cathode of the cathode follower is routed out J514 as "IF output." But, it also continues through C542 to the separate AGC strip for AGC and meter processing. So, does adjusting the slug in Z503 peak the meter signal (it's p/o the fixed-IF alignment procedure, so if you have a steady signal source you should perform that step anyway)? If Z503 peaks up, you may want to check tubes V508, V509, and V506 and look at that "downstream" AGC circuitry. This AGC/meter strip is separate from the main signal fixed-IF path. To help yourself sectionalize, do you see AGC action? If you do, then look more closely at the metering circuit components themselves. If not, the gremlin may lurk in the dedicated AGC/IF path. I hope that gets you started. Use colored pencils on a copy of the schematic to assist you in understanding the signal path--it's quite conventional. Also, the copy of the schematic from one of the original TMs (in .PDF) makes it easier to discern this as opposed to the "condensed" schematic in the "21st Century" reference.

By the way, I spent much of the weekend troubleshooting a TS-830S belonging to NX1F, Joe. The trouble was in the set's AGC feed. That ricebox was infinitely more difficult to troubleshoot than our venerable R-390As! Working with those awful Japanese schematics and bad reference designations and poor access for service really makes me appreciate the creme-de-la-creme of American engineering embodied in the '390As. It's why I own one. (BTW: I got the 830S working FB, but not after a goodly amount of sweat and cussing).

Date: Wed, 29 Nov 2000 00:05:54 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Level meter

The original meter is 1 mA 17 ohms so is 17 mV full scale and is in a low voltage, low impedance circuit. Your 50 mA meter probably is 1K and so a 50 mV full scale meter. You could try increasing the values of the resistors from each end of the meter to ground by a factor of 3 to get more voltage for the same tube currents.

Date: Sun, 03 Dec 2000 10:10:27 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] R725/URR and servo vs Se

Your meter is 300mv full scale while the circuit is 17 mv full scale. You can add gain (some use an op amp) but I'd change the resistor between each end of the meter and ground. I'd raise them by the factor 300/17. They still will be low compared to tube impedance. You can reduce the meter resistance with a shunt but you won't change the required voltage drop. The DB meter is a more common item, a VU meter from a recorder of broadcast console is appropriate. Its simple an audio meter made for monitoring the 600 ohm line output. It has little benefit to ordinary listening, it is important when setting the gains for feeding a radio repeater complex or some audio based signal processors as for RTTY or cryptography.

Date: Sun, 31 Dec 2000 13:44:03 -0500

From: "Jim Miller" <jmille77@bellsouth.net>
Subject: [R-390] More R-390A Newbie Questions

<snip> First, I noticed right off that the carrier meter seemed very "scotch". It is some kind of generic replacement by International Instruments. It's face bezel isn't as 'thick' as the line level meter. With the calibrate signal I could only get less than a eighth of full scale. Live signals werent much better. The AGC didn't seem to be working well either. I tried an quick alignment and replaced a couple of weak tubes in the IF and that helped slightly. So I went for it...I removed the IF module and went through it checking resistance values, looking for burned or aged components. I replaced the killer capacitor in front of the mech. filters and some others (per Chuch Rippel's web page). I found a 1K and a couple of 2200 ohm resistors that had fried or changed value. I also found a partial short to ground at a pin of Z503 which would account for poor AGC, and also for a blown fuse occasionally as it shorted B + to ground. So after all that, and a quickie realignment of the IF, I now get a whopping quarter scale reading on the calibrator, which still seems scotch. The receiver seems to have a lot of gain and hot signals but the meter reading is very low. My question is: Has anyone seen this problem with replacement meters or should I look elsewhere for a problem? <snip>

Date: Sun, 31 Dec 2000 14:04:33 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] More R-390A Newbie Questions

A replacement meter may have a greater movement resistance than the 17 ohms of the original. That will make it scotch. You might check the meter resistance. 50 ohms is far more common for a 1ma movement than 17 ohms. You might get a great indication by replacing the resistors to ground with larger ones, say three times the existing size on each side of the meter. Shunting the meter won't help. <snip>

Date: Sun, 31 Dec 2000 16:44:40 -0500
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] More R-390A Newbie Questions

First, the AGC that the rig develops determines the carrier meter level. If your AGC is not right yet, your carrier meter will also be low. Tune in the strongest signal on the band (local AM broadcast) with the BFO off, and measure the voltage at the AGC terminals on the back. Something close the -9 VDC would be about right. If AGC is correct, the meter is probably the problem. Dr. Johnson has given you some good recommendations on this. <snip>

Date: Sun, 31 Dec 2000 20:52:39 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] More on Meters

Yup, that's so true. There are a lot of replacement meters around and some are more of a "reach" than others. I have some of the kind that Fair has be using on checked R-390A's supplied with meters. These are Ideal/Dejur manufacture, nicely

made with a thick cast bezel, 50 ma movement. The meter scale is "arbitrary" with 8 major tick marks with half ticks between, under which is a "Lo-Hi" scale and Input V. I measured the DC resistance at about 1.9K -- quite a way's off from 19 ohms. Dave at Fair says he replaces one or two resistors in the carrier meter bridge circuit to get them to work reasonably (i.e. deflection/not pegging etc.) Using the same as an audio meter replacement along with a diode. Any thoughts? What resistor value changes would be needed and would that really provide any degree of accuracy?

Date: Sun, 31 Dec 2000 21:24:40 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] More on Meters

I presume that you mean microamps when you say 50 ma and 1.9K. That means a voltage drop of 95 millivolts. The bridge resistors are set to give a voltage difference of 17 millivolts (1 milliamp, 17 ohms). To get 95 millivolts difference you need the two resistors from meter to ground (one at each end of the meter) to be increased by a factor of about 6. The resistance and voltage to ground will still be so low that it won't detectably affect the operation of the tubes.

There is a procedure in the manual to check the meter sensitivity for the radio sensitivity so one can check the effect of the mod and odd meter on the meter display. I'd prefer a diode bridge to a single diode for the audio meter. And probably a capacitor across the meter to provide the hold typical of the VU type meter. The meter setting resistor should probably be on the AC side of the bridge to minimize the effects of the bridge rectifier on the audio.

Date: Mon, 1 Jan 2001 10:19:13 EST
From: DCrespy@aol.com
Subject: Re: [R-390] More R-390A Newbie Questions (carrier meters)

A few years ago Tom Bowes was selling kits that consisted of two of these international meters, a special tool, new meter scales and instructions to convert them. The key to making one work in the carrier level slot was short circuiting the internal (to the meter) dropping resistor to drop the resistance of the meter from 100 ohms to 38 ohms. This is higher than the spec 18 ohms, but I have found every meter with 38 ohms or less internal resistance worked just like an original (side by side comparisons). The big disadvantage is that you have to open up the meter. There has been plenty of discussion about the hazards of radioactive material in the meter on this list. You'll have to weigh the risk against a new \$79 original from SSN. I first would check the resistance on yours, though. Someone else may have already opened it up for you. If the resistance reads about 40 ohms or less, your problem is not the meter. If you need some help on ways to check meter resistance, send me a note.

Date: Mon, 01 Jan 2001 17:02:15 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] More R-390A Newbie Questions (carrier meters)

If the meter says 100 ohms on the face and the DMM says 39 ohms, its been

modified. DON'T EVER measure a meter movement with an ordinary VOM, the meter movement will be zapped if its sensitive. The safe way to measure a meter's resistance is to connect it to a supply through a fairly large series resistor and adjust the supply and/or resistor for exactly full scale deflection. Then add a shunt across the meter terminals and adjust it for exactly half scale deflection. (presuming the meter scale is linear which won't be true of meters for thermocouples and VU). The shunt resistor may then be measured after disconnection from the meter and is the same resistance as the meter.

Date: Tue, 02 Jan 2001 10:54:53 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] More R-390A Newbie Questions (carrier meters)

Alex, your DMM and my DMM have low current in their ohmmeter ranges. From this sample of three DMM's, I don't consider it safe to say that ALL DMM in ALL ranges keep the current low enough to not peg or damage a sensitive microammeter.

Date: Thu, 18 Jan 2001 01:37:22 -0000
From: "Fraser Bonnett" <fraserb5@home.com>
Subject: [R-390] R523 and Carrier Level

Would the fact that I can't zero my carrier level meter (R-523) is CCW against the stops and the meter still reads 20dB indicate a need to replace R523 or is there something else I should check?

Date: Mon, 05 Mar 2001 23:11:04 -0800
From: "Walter (Volodya) Salmaniw, MD" <salmaniw@home.com>
Subject: [R-390] Radiation counts in meters

Don't recall this thread before. Thought I would check my original metered 390A for radiation. My Line level meter reads 0.7 mR per hour, while the carrier level meter reads only 0.3 mR per hour. Thought this might be an interesting thread. Pull out the old geiger counter, and let's play "my meters are hotter than yours".....Walt.

Date: Tue, 06 Mar 2001 12:39:43 -0500
From: Jim Miller <jmiller@iu.net>
Subject: Re: [R-390] Radiation counts in meters

For comparion, what are the official limits for safety currently on record?

Date: Tue, 6 Mar 2001 11:58:39 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Radiation counts in meters

My '67 EAC shows nothing above "background" radiation.

Date: Tue, 6 Mar 2001 19:44:11 EST
From: DuffyF56@aol.com

Subject: Re: [R-390] Radiation counts in meters (information)

The radioactive material used in the R-390A is radium which is formed from the natural disintegration (radioactive decay) of uranium. When mixed with zinc sulfate, radium forms the luminous paint used on the meters. Radium releases primarily alpha and beta particles as well as some gamma. Not sure what kind of meter you used to detect the radiation you did but frankly I am somewhat surprised. The radioactive half life of radium is 1,620 years so perhaps I should not be. When radium radioactively decays it forms radon gas which almost exclusively an alpha emitter. Alpha and beta particles can be stopped with as little shielding as a piece of AL foil. Alpha is actually stopped by a dead layer of skin so unless digested presents no hazard what so ever. As far as the allowable exposure part of the question posed the Federal Regulations allow radiation workers to receive 3 rem per quater up to 5 rem per year if memory serves.

While on the subject of radioactivity I am sure most of you are aware of the radioactive nature of your OA2WA tubes aren't you?

Date: Tue, 06 Mar 2001 20:04:28 -0500
From: Glenn Little <glittle@awod.com>
Subject: Re: [R-390] Radiation counts in meters

The last time I checked, the radioactive meter faces and pointers on the R-390A were alpha emitters. From my radiological training, alpha will not penetrate something as thin as a sheet of paper. If you are reading anything above background on an R-390A meter someone has done something to it. You could get a reading if the glass front was broken, otherwise nothing from the stock meter.

Date: Tue, 06 Mar 2001 20:37:46 -0800
From: "Walter (Volodya) Salmaniw, MD" <salmaniw@home.com>
Subject: Re: [R-390] Radiation counts in meters (information)

Great overview, Duffy. I'm assuming that the meter is indeed picking up gamma radiation. My premise was to get others to examine and measure the radiation, not rekindle the controversy over it's safety or not. As Jan Skirrow rightly pointed out, unless we plaster the meters to our foreheads for years on end, there is little to worry about, UNLESS, the meters are opened and tampered with and the contents ingested or inhaled. Then indeed, there could be big problems. Remember the inverse square law, and don't worry!Walt.

Date: Wed, 07 Mar 2001 20:24:25 -0800
From: "Walter (Volodya) Salmaniw, MD" <salmaniw@home.com>
Subject: [R-390] Radioactive meters

There appears to be quite a bit of misinformation about radiation emitted by the original meters. The alpha and beta particles being of very low intensity would not be an issue as they would not pass through the glass enclosure. Period. However, gamma radiation is emitted by the radium source, explaining what my geiger counter is picking up. If your meters don't pick anything up it can only be because,

a/ meters are not original b/ radioactive source is depleted sufficiently to minimize radiation or, c/ defective geiger counter, or I suppose d/ some meters were not "hot". I refer you to an excellent website explaining the process:

<http://physics.nist.gov/GenInt/Curie/1927.html>

As you can see, radium decay has a high energy gamma component. The article has info on the "half thickness" of various materials - which is a measure of their stopping power for radium decay products. They suggest a 15mm piece of lead to shield the detector from soft gamma. Obviously hard gamma is gonna penetrate a piece of glass, and I would strongly expect some of the soft gamma to as well if it takes 15mm of lead to be sure of stopping it.

Date: Wed, 7 Mar 2001 21:31:56 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Radioactive meters

I remember someone mentioning that the later EAC contract didn't have "HOT" meters, mine doesn't show any radiation with my geiger counter tested against the sample on the side of the counter. NOW, if we want a more accurate comparison: I went out to my 1952 GMC 6 X 6, that's a truck for those who don't know, and checked the speedometer, which still glows in the dark. THAT is one HOT little sucker! It measured 45 mr/hr on the scale of the Anton Electronics CD V-700 Model 6. That's 0.45 on the scale with the knob set to the X100 setting. That's with the glass intact, too, with the probe set tight to the glass. There it is! The '67 EAC with original meters is NOT "HOT", but the truck,..... well,..... guess I gotta dig a BIG HOLE.

Date: Sat, 7 Apr 2001 13:00:56 -0400
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] Three 390 questions

> Can the (new) carrier meter I have be made to give a more "excited" reading than what I get? >(Changed out w/non a meter, and it read 20 db higher on same sig.)
Has this been common on >these replacement meters?

You can change R548 from 27 ohms to 39 ohms to get slightly more response from the substitute meters. Going any higher does not seem to help. Fair Radio makes this mod on their radios with substitute meters. Even then, I've not seen a substitute meter ever give as much deflection as the original.

Date: Sat, 7 Apr 2001 13:30:26 -0400
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] Three 390 questions

I read somewhere about the idea of making up a small op-amp circuit to adapt the substitute meters. (Bill Lavick was planning on it, last we spoke.) Has anyone done that? Probably could be small enough to hand on the back of the meter or somewhere nearby and tap power from the lamp wiring. The problem is that some

of the "replacement" meters being used now are a even longer reach away from the 17 ohm originals than the previous subs. Of course, we could start that "Hey gang, let's get some new meters made!" thread again <groan>.

Date: Sat, 7 Apr 2001 11:36:18 -0700
From: "Kurt" <radiouser@uswest.net>
Subject: Re: [R-390] Three 390 questions

Look at <http://www.skirrow.org/boatanchors/articles.htm> and select "Adapting "Found " Meters to the R-390A". Jan has done a good job in solving this problem. The circuit is simple and works just fine.

Date: Sat, 7 Apr 2001 12:53:15 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] Three 390 questions

"Why did they design the curved handles? (I mentioned the better curve on the orig. non a handles yesterday, and someone asked me, instead of the list..)"

By curved, do you mean the way the handle is curved so that it lines up with the rack screws? I figured that was to discourage people from taking them out of the rack. Looks pretty on the bench, but driving the first screws when replacing the set is a real pain. Group, did this vary with manufacturer? The sets I've seen from R-388 to R-391, including the R-390A, all have handles that are curved to cover the rack mounting screws.

Looking again at it, the MC Change knob could not be grasped and changed easily with handles that came straight out. But the handle didn't have to interfere with the rack screws. Must have been a committee decision.

#2 "Can the (new) car. meter I have be made to give a more "excited" reading than what I get? (Changed out w/non a meter, and it read 20 db higher on same sig.) Has this been common on these replacement meters?"

This is a FAQ that ought to be on some web sites. The internal resistance of "replacement" meters is too high. It would take an active amplifier to restore sensitivity. To measure internal resistance of a 1 milliamp meter, hook it in series with a 12 K resistor to a 12 volt supply and adjust R or V so the meter reads full scale. Now connect resistors across the meter terminals until it reads half scale. The meter reads half scale when the resistance across the terminals equals the internal resistance of the meter.
and:

#3 "The BFO takes a few min. to get "on line" after turning the radio on. Tube checks high. Comments, PLEASE??"

Temperature affects the value of all components. There are tricks to cancel out these effects over some temperature range, but they are expensive. So the PTO has expensive compensated components but the BFO does not. Or did you mean

that your BFO doesn't even start to oscillate for a few minutes?

Date: Sat, 7 Apr 2001 12:30:18 -0700
From: "Kurt" <radiouser@uswest.net>
Subject: Re: [R-390] Three 390 questions

Lets try this again. John, you can get a solution to your meter problem by looking at: <http://www.skirrow.org/Boatanchors/> . Select "Articles" at the top of the page. Then select "Adapting "Found" Meters to the R-390A". Sorry for the error.

Date: Sat, 7 Apr 2001 20:13:52 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] Three 390 questions (Original meter identification)

>It has a 0 to 100 scale labeled DB and has the name INTERNATIONAL on the dial.....

International was one of the original R-390A meter suppliers. I had them on an Amelco i had a few years ago.

Date: Sat, 7 Apr 2001 21:06:04 -0400 (EDT)
From: "Paul H. Anderson" <pha@pdq.com>
Subject: Re: [R-390] Three 390 questions (Original meter identification)

I have seen reproductions, but mostly of Simpson or others. You can sort of tell an original meter - yellow or yellowing lettering, aged looking, but still crisp lettering. Reproductions that I've seen usually have "something" wrong with them - fuzzy letters, crisp white letters, "too clean" or obviously a hack job. You can make perfectly nice reproduction faces and find good movements, but it is kind of hard to reproduce that 50's look. I think you can usually see the raised letters (the paint sticks up a little), and that makes them different than the more recent computer printed ones. I'm sure more experienced people could tell you the vintage of different meters used on which approximate contracts, but even then, I would bet the military would swap meters in a second if they needed to get a unit working. There are later replacements made by ideal that have a newer appearance, but they are very professionally done, and it is hard to duplicate the crispness of them, too, in my opinion, but I'm sure someone seriously motivated could do it.

Date: Sun, 8 Apr 2001 09:12:06 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] 67 EAC odd Audio Behavior

Look at the resistor board near top of front panel, see if R113 has been clipped. That will cause the problem, also makes the line level meter readings off.

Date: Tue, 26 Jun 2001 15:09:28 -0400
From: "john page" <n8blb@hotmail.com>
Subject: Re: [R-390] Broken meter

From the "for what its worth" dept. Awhile back I had a meter that was inop and would not deflect. I used an ohmmeter to test it. Took it apart and started making checks internally. Found the circuit open through the front bearing. I believe someone on here referred to it as the adjustment gizmo. What ever you call it, it should conduct, but it did not. A drop of De-Oxit and it has been working ever since. It worked for me and maybe it will for you.

Date: Tue, 26 Jun 2001 15:08:06 -0500
From: "Scott, Barry (Clyde B)" <cbsscott@ingr.com>
Subject: RE: [R-390] Broken meter

Hmmm, that's something I did not try. It certainly can't hurt. I have a feeling it might not help me, though, because I was able to get the meter lead onto the solder point of each side of the coil and was not able to get continuity there. Along the lines of meter questions, this particular movement has a cylindrical object that is suspended inside the coil. Anyone know what this is for? The magnet is around the outside of the coil, so, while I'm sure it isn't useless, this part of the gadgetry appears to have no function.

Date: Tue, 26 Jun 2001 17:29:47 -0400
From: Bob Camp <bob@cq.nu>
Subject: Re: [R-390] Broken meter

The meter coil sits in a magnetic field between two ends of a permanent magnet. It bytes a fairly large "chunk" out of the magnetic field at that point. I have always *assumed* that the part you are talking about was there to more or less complete the magnetic circuit as much as possible. This would increase the field in the vicinity of the coil and let you get away with a smaller magnet. I'm also sure it has a name haven't a clue what it's called. Sorry about that

Date: Tue, 9 Oct 2001 10:01:11 -0400
From: "AI2Q Alex" <ai2q@adelphia.net>
Subject: [R-390] Line and Carrier meter bezels

Last weekend at the Hoss Traders hamfair (Hopkinton, NH) I got to chatting with a couple of R-390 and R-390A owners. The conversation turned to the Carrier and Line level meters, and I happened to mention that on my Collins R-390 each of the original meters have a small indentation on the portion of the black bezel that runs horizontally across the bottom edge of the glass face. In other words, the flat side of the "D" cutout has what appears to be a rolled-in form to the metal. The meter bezel on my Stewart-Warner R-392 appears the same way. But, the glass seems perfectly fitted on all these meters. In contrast, the meter bezels on my Motorola R-390A are entirely flat. Also, the metal bezels seem more substantial (thicker). And, like the R-390 and -392, the glass is perfectly flat against the inside edge of the meter bezel. Has anyone noticed this difference? Are the meter bezels on the R-390 and R-392 damaged? Could that happen so uniformly? Were there variations from meter vendor to meter vendor when these were subcontracted? Your thoughts gentlemen?

Date: Tue, 9 Oct 2001 07:37:57 -0700 (PDT)
From: "Tom M." <courir26@yahoo.com>
Subject: Re: [R-390] Line and Carrier meter bezels

There were a number of meter makers used in the family. I have a rackup at home, but basically there are many types of cases. The latest are the A&M models with the bevel all around the opening.

Date: Tue, 9 Oct 2001 08:47:22 -0700
From: David Wise <David_Wise@phoenix.com>
Subject: RE: [R-390] Line and Carrier meter bezels

My Depot-ed 363-PH-54 Motorola has one of each. Just a data point.

Date: Tue, 9 Oct 2001 17:04:51 -0500
From: "Scott, Barry (Clyde B)" <cbsscott@ingr.com>
Subject: RE: [R-390] Line and Carrier meter bezels

I had one of each type of bezel on my '56 Motorola. When I refinished the front panel, I thought the bezel was simply bent and flattened it before finishing so it would match the other meter. Ooops?

Date: Wed, 10 Oct 2001 12:11:17 -0400
From: "AI2Q Alex" <ai2q@adelphia.net>
Subject: RE: [R-390] Line and Carrier meter bezels

Thanks for your note Ed. Now I know that I'm not (entirely) crazy! GL on finding those bezels. I'll keep an eye out for 'em for ya. You might have to cannibalize a meter here and there though. -- Vy 73, AI2Q, Alex .-.-.

Subject: Re: [R-390] Line and Carrier meter bezels... Hi, Alex: It's very interesting that you mention that. I also have a Motorola R-390A ('56) and it has the flat bezels that you mentioned. I have a Stewart-Warner with the rolled-edge bezel and I assumed that it was damaged too. Then I picked up another Stewart-Warner and the line meter has the rolled-in edge (the carrier meter is a replacement). I have a non-A that had no bezels: you can see the screws that hold the meter together! I thought it was a different kind of meter when I first saw it; then realized that just the bezel was missing. Of course finding them isn't easy!

Date: Wed, 10 Oct 2001 14:10:32 -0400
From: "AI2Q Alex" <ai2q@adelphia.net>
Subject: RE: [R-390] Line and Carrier meter bezels

Ed, when I recently did a forklift restoration of a badly fire-damaged R-390, the disassembly process included removal of the bezels. Once the mounting screws were removed, the bezels came right off. I would have to carefully inspect the meters to see if I can tell you what subcontractor made them.

Date: Wed, 24 Oct 2001 13:28:44 -0500

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: [R-390] Replacing carrier adjust potentiometer

The carrier-level pot in my R390A will not stay adjusted. I've tried several applications of DeOxit, but to no avail. I purchased a ten-turn wirewound pot with the intent of replacing the original, but when I tried to fit the new one in place, it wouldn't go. It is necessary to loosen (remove?) the bracket that holds the two pots, do the replacement, and reinstall the bracket. The problem lies in the fact that I can't get to the screw heads when the pots are in place.

Has anyone any experience doing this? Is there another way? I don't have a right-angle phillips-head screwdriver and I'm not sure if there would still be enough room to use it even if I did.

Date: Wed, 24 Oct 2001 19:30:08 -0400
From: Bob Camp <bob@cq.nu>
Subject: Re: [R-390] Replacing carrier adjust potentiometer

Apparently the way you do it is to file out the mounting hole larger and then kinda swing the pot into place. Another way to go would be to get a very low value single turn pot and use it in place of the existing 100 ohm (?) unit. As I recall they put about a 10 ohm resistor across the 100 ohm pot. The result is just about guaranteed to be a pain to work with. If you could find a 5 ohm or even something smaller then you could put a resistor in series with it instead of across it. It would give you all the resolution you would need but it might fit a lot better.

Date: Wed, 24 Oct 2001 19:58:28 -0700
From: "Kurt" <radiouser@uswest.net>
Subject: Re: [R-390] Replacing carrier adjust potentiometer

What brand of ten turn pot are you using? I use a Spectrol model 534 with a metal shaft and can get them to go through the hole without removing the mounting bracket. I have been able to do this on four different IF decks by temporarily removing the gain pot and working the ten turn pot into place in a direction of rotation, backwards from what you would think should work. If you do need to remove the mounting bracket, do not completely install the new pot before reinstalling the mounting bracket. This will get you more room to get to the screws to tighten things up.

Date: Thu, 25 Oct 2001 15:22:15 -0700
From: "Roger L Ruskowski" <rlruszkowski@west.raytheon.com>
Subject: Re: [R-390] Replacing carrier adjust potentiometer

I am so happy you kicked this topic off. In my years I never seen the carrier meters as real functional items on the R390/A. As you say, The carrier-level pot in my R390A will not stay adjusted. I just lost some other mail here that suggest we modify the span resistor on the adjustment pot. Then maybe add a few ohms in series if needed. Folks, will this really make the meter action more usable? The

theory is good. But will the circuit function.

I know my receiver is having problems in the AGC and carrier meter circuit. I has been acting bad as long as I have owned it. I have went at it a few times and just suspect I have not gotten all the leaky caps out of the circuits yet. But as I remember carrier meters from years past when both the receivers and I were younger, the circuit just did not act real good. Poor meter response, and bad zeros. We tried to keep them under 10 and off the peg.

What should we look at in the meter circuit? What aging parts are giving folks fits? Before I go the op amp mod route, what should be tested and corrected to get the best functionality out of the circuit as designed and built.? Until I can get that far, any op amp just amplifies the problems.

Date: Thu, 25 Oct 2001 19:07:48 -0400
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] Replacing carrier adjust potentiometer

Must be more to it, the carrier level on my '67 EAC S-meter has been stable for 4 years. More than I can say for the S-meter on my WE 75S-3B where the consensus is that there is no fix.

Date: Thu, 25 Oct 2001 20:15:39 -0400
From: Bob Camp <bob@cq.nu>
Subject: Re: [R-390] Replacing carrier adjust potentiometer

When you get the pot set up right the carrier meter actually works pretty well. It's amazing to me that it is as accurate as it is. I can crank off the 10 db steps on the attenuator on the signal generator and the meter will follow right along. They are not the best on the bottom 10 db of the range but past that they work pretty well. The problem is simply that the set pot circuit was not done right. I'm pretty sure that this happened either as a last minute mod to the circuit or because mil-spec pots did not come in values below 100 ohms in those days. My bet would be on the pots not being available.

The circuit is a simple DC circuit with no AC involved. This makes fiddling with it fairly easy. Anything that puts about 10 ohms from the meter plus cathode to ground will do the trick. You could use a decade resistor box and then wind a custom resistor if you wanted to. Inductance and all that would not matter at that point in the circuit.

As with any DC circuit using tubes it will only be stable after the tubes have aged in some. I would guess that a run of 24 to 48 hours would be a real good idea any time you changed a tube. Once they have burned in then adjust the carrier meter.

Since the meter is part of the AGC circuit any of the usual AGC problems (leaky caps and the like) will mess up the meter readings. Even with a fancy op-amp setup you would still be stuck with exactly the same problem. It's the AGC operation the generates the signal strength signal. Also since the rest of the radio is full of tubes

simply having a meter circuit that didn't drift would not fix the problem. As the rest of the radio moved so would the AGC and the signal it generates.

Best way to go is to come up with an easy adjustment. You could even route it to the back panel if you wanted to.... Enjoy! Bob Camp KB8TQ

Date: Fri, 26 Oct 2001 09:15:31 -0700
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: [R-390] Carrier Meter Circuit Ills

Must be more to it, the carrier level on my '67 EAC S-meter has been stable for 4 years. More than I can say for the S-meter on my WE 75S-3B where the consensus is that there is no fix. Jim

- -----

Right, Once you pick a point the meter acts OK and is usable. The adjustment is just picky and if we moved the receivers around between the shop and the bays. The zero point would bump around. The ones in the vans on the "roads" were less stable. Now we have older receivers were you cannot get the same reading 2 days in a row. As Barry finds, the problem is not necessarily the adjustment pot Roger.

- -----

Hi, When you get the pot set up right the carrier meter actually works pretty well. It's amazing to me that it is as accurate as it is. I can crank off the 10 db steps on the attenuator on the signal generator and the meter will follow right along. They are not the best on the bottom 10 db of the range but past that they work pretty well.

Date: Sat, 27 Oct 2001 10:42:37 -0400
From: dmclaughlin3 <dmclaughlin3@neo.rr.com>
Subject: RE: [R-390] Replacing carrier adjust potentiometer

I also had this problem. The carrier-level pot measured 135 ohms end to end. Measuring from the wiper to an end it was not smooth and would jump up to 145 ohms at the normal adjustment point. I replaced the pot with a Clarostat RV4LAYSA101A. Bought at Dayton Hamvention from Mendelson's for \$.50. Digikey also sold Clarostat pots. I got the gain pot from them. The RV4 style is larger in diameter than the original RV2LAXSA101B type. I changed both pots. They will fit if you loosen up the mounting bracket. I now have a stable carrier level meter zero.

Date: Mon, 29 Oct 2001 07:56:36 -0600
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: [R-390] Carrier-level adjustment news

I was finally able to replace that pot with my new 10-turn pot. It's great to finally be able to set that thing with some assurance it will stay set -- especially with the advantage of a bit more "fine-tuning" ability. You can really see the results of the windings in that pot, though. Naturally, it isn't infinitely adjustable and you can "see" the different "taps" as you adjust it, but you can get a reasonable zero point

pretty easily. After several suggestions on how to fit the replacement pot, I did the following.

1. Remove both pots (IF gain and CarrierLevel)
2. Loosen sufficiently (~1/8 inch) or remove the bracket screw closest to the IF gain pot.
3. Lift the bracket on the IF gain side sufficiently to allow the CarrierLevel pot to slide in place.
4. Replace/Retighten the bracket screw underneath the IF gain pot.
5. Replace the IF gain pot.
6. Wire as needed.

By the way, I opened the old pot just to see if there was any way to restore it, but there doesn't appear to be a way. The thin layer of carbon is easily scraped loose, so it can't really be cleaned. If DeOxit hasn't worked, there doesn't appear to be more can be done to "stabilize" it

Also put the CL80 inrush current limiter in place. I think I may actually have done everything I wanted to do to this one. Looks like time to look for another one (or two)?

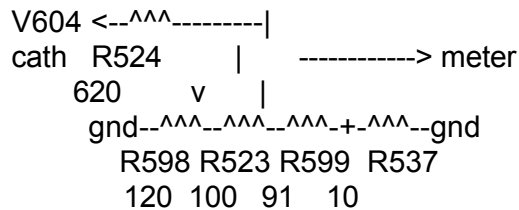
Date: Thu, 1 Nov 2001 14:36:47 -0800
From: David Wise <David_Wise@phoenix.com>
Subject: RE: [R-390] Replacing carrier adjust potentiometer

I don't think you can get a sub-100-ohm carbon pot.

If you compare the R-390 with the R-390A, you will find that the former has a 15-ohm WW, while the latter has the 100-ohm carbon || 22-ohm fixed that we love to hate. A comment in the Cost Reduction Report says this change was a response to the discrete steps of the old WW pot. As you've seen, retrofitting a WW, even a 10-turn, brings back the discrete steps. Here's why:

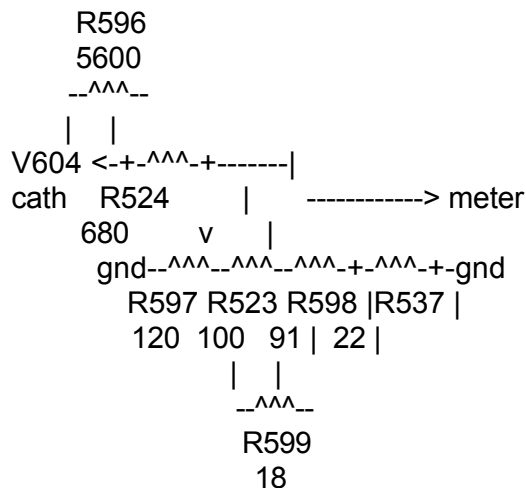
The R-390A arrangement is continuous, but it's also very nonlinear. According to Y2K Figure 5-6, V506A idles with about 100mV at the cathode. V504 cathode is 9V which puts 13mA through the R524/R523/R537 network. To get 100mV (i.e. meter zero), R523||R537 must be 13 ohms, i.e., R523 must be 32 ohms or about 1/3 rotation.

For smaller offsets things deteriorate rapidly. My V506A idles at 60mV instead of 100. This requires 4.6 ohms total or R523 = 5.8, which is practically against the stop. Why such an awful circuit? It was probably a combination of dismissal as unimportant, and reluctance to increase cost. I've figured out a scheme that is much more linear but requires two extra resistors:



R524 changes from 680 to 620.
R537 changes from 22 to 10.
R523 is the same.
R598 and R599 are new.

A slightly less-intrusive variant requires four new resistors but leaves all the old ones in the circuit:



With this arrangement, V604 sees between 675 ohms and 686 ohms, and the meter sees between 49mV and 90mV at an almost constant 10 ohms. Mid-rotation gives 69mV, which is almost exactly linear. If you have an exceptional combination of tubes (one hot and one weak), change R599 to the next higher or lower value. I haven't tried this, but I probably will. Ok, pick it apart, guys. IMO, the only problem is mechanical: you need a terminal strip to support the new nodes. If you're using Jan Skirrow's op-amp meter driver, this fix would work fine alongside it, but it's not the easiest way. More on that (and on my own op-amp meter driver circuit) in another post.

Date: Fri, 2 Nov 2001 10:02:35 -0800
From: David Wise <David_Wise@phoenix.com>
Subject: RE: [R-390] Replacing carrier adjust potentiometer -- YOUR TROUBLES ARE OVER

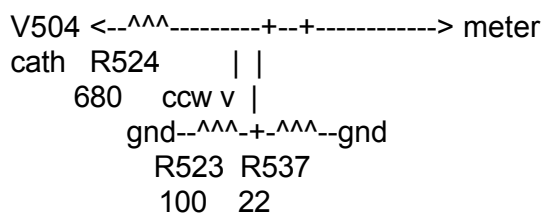
Sheesh, I'm slow. Even a simple idea takes a while to gestate. Forget my suggested circuit from the previous post. I now present THE BEST R-390* ZERO-SET MOD IN THE KNOWN UNIVERSE It's so simple and so perfect, it will bring tears to your eyes. Why didn't Collins get it right? I have to conclude that the carrier

meter circuit was relegated so a junior engineer who spent about five minutes on it. These instructions are based on my 363-PH-54 R-390A but the idea is applicable to all R-390As. It can also be adapted to the R-390, if you switch from 15-ohm WW to 100-ohm carbon + 22-ohm fixed a la R-390A.

R523 has, on its wiper,

1. A white wire with green and blue stripes which goes to R524.
2. A white wire with orange and blue stripes which goes to the meter.
3. A jumper to the clockwise end of R523, which in turn has one end of R537.

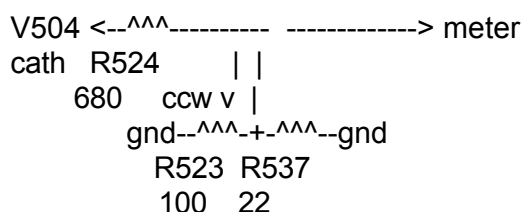
BEFORE



Do this:

1. Remove the jumper.
2. Move the meter wire from the wiper to the CW end.
3. Sit back and smile. The adjustment is now linear, with zero near the middle.

AFTER



Fine points:

If you have already put in a 100-ohm ten-turn, you can keep it. Just change the wiring as above to get micrometer-accurate zeroing with no jumps. V504 used to see 680-698 ohms. Now it sees 680-710. This is still well within R524's 10% tolerance and causes no detectable change in gain. If you're feeling anal-retentive, pull the IF deck and add a 22K across R524. On my set, the meter looked to V506A like 18+5 = 23 ohms. Now it looks like 18+18 = 36 ohms. This increase in impedance will make the meter read lower for a given signal, but this is a good thing, because mine used to read hot. I used my HP 608D signal gen with dB-calibrated attenuator. I started at meter threshold and turned up the generator in 10dB increments. The meter went up by more than one division each time from 10 to 60 where it started flattening out but was still high at 100. Now it's hot from 10 to

60 and cold from 70 to 100. Looks like they weren't too careful with the scale. It needs to be spread at the bottom and squashed at the top. If you look carefully, it already is, but needs to be more so. If your meter reads cold all the way across, change R537 from 22 to 10 and rezero.

If you're using Jan Skirrow's op-amp meter driver, this fix will work fine alongside it. I have perfected (heh) my own op-amp circuit, for those of you with an LM339 burning a hole in your pocket.

Date: Mon, 5 Nov 2001 18:00:44 -0800
From: David Wise <David_Wise@phoenix.com>
Subject: [R-390] Re: Carrier Meter TROUBLES ARE OVER

Final update. I changed R537 after all, after calculating that with a 60mV idle the meter theoretically can't reach full scale. It did, however. Hmm. 4th IF grid current? Anyway, I changed it from 22 ohms to 15 ohms. This gives me just a hair over FS without skewing the scale. Works great. All you who've cursed at R523, you really should try it. My previous post, that is, not just the R537 change; alone that will do nothing noticeable.

Date: Tue, 6 Nov 2001 08:39:38 -0800
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: [R-390] Carrier Meter TROUBLES ARE OVER

Dave, Thanks for putting you mind into this subject for us. I am about to put your circuit changes into my receiver I just knew the carrier meter circuit could be better. I did not expect the fix to be so easy. Roger KC6TRU San Diego

Date: Tue, 6 Nov 2001 08:39:38 -0800
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: [R-390] Carrier Meter TROUBLES ARE OVER

>Final update. I changed R537 a<snip>

Dave, Thanks for putting you mind into this subject for us. I am about to put your circuit changes into my receiver I just knew the carrier meter circuit could be better. I did not expect the fix to be so easy. Roger KC6TRU San Diego

Date: Wed, 28 Nov 2001 02:12:21 -0800 (PST)
From: MICHAEL OBRIEN <mikobrien@excite.com>
Subject: [R-390] (2) r-390a meters

I did some checking on the 2 meters. They both are the same model and were used for both the vu and carrier meters. They have a 50 micro amp movement and measure aprox 1900 ohms. That is different from my original carrier meter (1 ma and 18 ohms) Fair did put a diode in line with the vu meter I do not know what changes they did for the other one. Maybe the r-390 list can help us out with more info.

Date: Wed, 28 Nov 2001 06:14:01 -0500
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] (2) r-390a meters

The substitute meters you reference do indeed give reasonable meter deflection both for the line meter and carrier level. But they perform differently from the originals in the following respects:

1. The line level meter requires the diode which you mention. The R-390A is able to drive these meters, but the fast action of the original VU meter is lost with the substitute meters. The substitutes have a much more damped meter movement than the originals. Not a problem for most, unless you've grown accustomed to the original ones.
2. The substitute carrier level meter will not get full deflection for the same level of input signal. I've seen about 70dB deflection on a 100dB signal change in one case where I took the time to measure it. You can increase the value of R548 in the IF deck to get more deflection (I've seen this a number of times on R-390As from Fair Radio). But changing R548 has some effect on the AGC circuit, and I've seen the AGC bias voltage decrease (more positive voltage, less negative bias) with these modifications. So full deflection with a substitute carrier meter is a trade-off.

Date: Wed, 28 Nov 2001 11:03:20 -0800
From: David Wise <David_Wise@phoenix.com>
Subject: [R-390] RE: (2) r-390a meters

Walter Wilson beat me to it. It appears he's tried this model of meter before. I haven't, so my analysis is academic. Read it if you like: These meters will give useful but inaccurate displays.

1 (vu). The reading will be zero for all voltages that peak less than about 0.5 (silicon) or 0.2 (germanium). I believe real VU meters use a special type of meter movement that does not require rectification, or a rectifier that starts conducting from 0V. Hmm, I guess you could get close with a Schottky diode. Then some calibration would be in order to find at least 0VU and -10VU. Walter says the ballistics are off too.

2 (carrier). The AGC time constant tube puts about 0 to 2.5 mA through a 27 ohm resistor, yielding a delta of about 70mV for an infinite-impedance meter. 1900 is close enough to infinite in this context. 70mV/1900ohm is about 35uA or about 70% scale*. For a 50uA meter to reach full scale in an untampered R-390A, it has to be 1300 ohms or less.

If you drive the 4th IF into the positive-grid region, it will boost the meter further. This is how you can get a carrier deflection in MGC mode., but that won't happen when AGC is on unless the signal is in the Volts range.

Both of these meters could have an op-amp circuit grafted onto them to get realistic deflections. The carrier circuit has been analyzed in detail and the R-390 list

archives contain two usable circuits (mine and Jan Skirrow's). I don't know a VU circuit but I'm sure one is possible. It could be tough to compensate the ballistics, but only the purists would care and they won't be buying these meters anyway. The existing scales are inappropriate and should be replaced with R-390A VU or carrier reproductions. Now that I've sandbagged you, let me compensate by saying that if I had a meter-less R-390A, I might buy them.

Date: Wed, 28 Nov 2001 14:14:40 -0800
From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] RE: (2) r-390a meters

Are there any replacement scales available for "real" meters? The carrier level meter on my R-390 must include quite a bit of phosphor and radium, for now it is brown and dull. Also, on an R-390A, I have a VU meter that is a VU type, but with a slightly different scale. Actually, if someone has a spare carrier meter that needs a VU meter, I would be willing to trade, as the R-390A is now blessed with two VU meters (the meter in the carrier position is just there to fill the hole) and needs a carrier meter. Note, as mentioned above, that the VU scale is ok, but the style not quite according to Hoyle.

From: "Kenneth Crips" <w7itc@hotmail.com>
To: r-390@mailman.qth.net
Subject: RE: [R-390] Below 8mhz problem
Date: Wed, 23 Jan 2002 17:39:52 -0700

RE: <http://www.atc-us.com/ATCSHOP/>

Check out the meters for 18.00 they look very much like the originals for the R390.

From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] Below 8mhz problem
Date: Wed, 23 Jan 2002 20:00:04 -0500

I have some of those meters in the shop. They are 100 uA full range, instead of the 1mA for the R390 carrier meter. I have not measured their internal resistance.

Date: Fri, 1 Feb 2002 11:56:34 -0500
From: "Alex McDonald" <amcdonald@toyodatrw.com>
To: <r-390@mailman.qth.net>
Subject: [R-390] Line Meter wiring

I have a blue-striper which I received without meters. In attempt to hook up a meter I found that 3 wires were cut for the line meter. I can only find 2 wires listed to connect to the meter on a schematic that I have, (no wire color code specified).=20 My wires come out of a tightly bound pack. They are white wires with a single stripe each of black, red and orange. The black one seems to originate from somewhere low in the radio. I assume that 2 of the wires hook to a single post on the meter. Does anyone know the correct setup of these wires to the meter?

From: David Wise <David_Wise@Phoenix.com>
To: 'Alex McDonald' <amcdonald@toyodatrw.com>, r-390@mailman.qth.net
Subject: RE: [R-390] Line Meter wiring
Date: Mon, 4 Feb 2002 15:21:35 -0800

<snip> > My wires come out of a tightly bound pack. <snip>

Download the Y2K R-390A manual from the FAQ site, Alex. age 6-83, Figure 6-35 Radio Receiver R-390A/URR, Main Frame Wiring Diagram (Sheet 1 of 2). The White/Red goes to meter minus, the two White/Black/Orange go the plus.

From: "Bill Riches" <bill.riches@verizon.net>
Subject: RE: [R-390] Wiring question
Date: Thu, 4 Apr 2002 14:00:01 -0500

White-orange-blue wire and white-green-blue to center terminal (which is connected to one of the end terminals) and the plain white wire goes to the other end terminal.

From: "Frank" <fstyron@nc.rr.com>
Subject: RE: [R-390] Wiring question
Date: Thu, 4 Apr 2002 18:20:43 -0500

John, I took a picture knowing that I would be distracted before I completed the carrier adjust mod. Well, two days later, it came in handy ;-). If you would like to see the picture point your browser to: <http://home.nc.rr.com/fs/r390a/390a.htm>

From: Helmut Usbeck <vze2gmp4@verizon.net>
Date: Sat, 18 May 2002 12:40:09 -0400
Subject: [R-390] Carrier level meter

Has anyone used Jan Skirrow's, VE7DJX op amp circuit, that makes "replacement meters" useable in an R-390a? So far I've built two circuits using Jan's values but with a 741 op amp. Can't get the thing to work at all. Does someone have a circuit they've tried and gotten good results with it? Thanks.

Date: Sat, 18 May 2002 22:10:57 -0700
From: "Walter (Volodya) Salmaniw" <salmaniw@shaw.ca>
Subject: Re: [R-390] Carrier level meter

Helmut, Jan's article can be found at his website: <http://www.skirrow.org/Boatanchors/TechTalk2.pdf>
Good luck!.....Walt.

PS: I have one of these meters installed thanks to Jan, in my 390A, and it works fine.

Date: Fri, 26 Jul 2002 10:29:23 -0400 (EDT)
From: Helmut Usbeck <vze2gmp4@verizon.net>

Subject: [R-390] carrier meter

Does anyone have the microvolt equivalent of the db scale on the 390a carrier meter?

From: DJED1@aol.com
Date: Fri, 26 Jul 2002 18:46:12 EDT
Subject: Re: [R-390] carrier meter

The meter is supposed to read in dB relative to 1 microvolt. The curve in the manual (TM-856A) shows 10 microvolts at 20 dB, increasing 20 dB for every 10X increase in voltage, up to 100,000 microvolts at 100 dB. I haven't found it to be very linear in dB, and you can vary the scale substantially by setting the IF gain at different levels. If set as intended, I usually assume "S9" is at the 40 dB mark.

From: "Dulaff, Paul" <PDulaff@dpconline.com>
Date: Tue, 30 Jul 2002 16:14:44 -0700
Subject: [R-390] Replacement Meters for the R390A

What are the alternatives to using SSN replacement meters on the 390 ? I understand that the SSN meters are an OEM replacements, but they are pricey.
<snip>

From: Llgpt@aol.com
Date: Tue, 30 Jul 2002 19:20:21 EDT
Subject: Re: [R-390] Replacement Meters for the R390A

By SSN do you mean Surplus Sales of Nebraska? If so, their replacement meters are the late R-390A replacement meters. Exact matches. I believe that there was a thread that said they were out at one time, but not sure. I know someone who purchased a set, very nice NOS stuff. Les Locklear

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Replacement Carrier Level Pot.
Date: Tue, 2 Jul 2002 09:08:36 -0500

As I recall, it was pretty much plug-n-play. The only hitch is fitting the pot in place. It is "deeper" than the original one. Again, if memory serves, I took both pots out of the bracket, removed the screw under the other pot (enabling me to pull the bracket up just a tiny bit), put the Clarostat in, replaced the screw, and then the other pot. Wiring was straight forward. BTW, you're going to like it when you get it in place. You can "see" the windings as you adjust it, but it stays PUT once you get it where you want it!

Date: Tue, 2 Jul 2002 08:15:51 -0700 (PDT)
From: "Tom M." <courir26@yahoo.com>
Subject: RE: [R-390] Replacement Carrier Level Pot.

On most radios, the adjustment wants about 7-8 ohms for zeroset. I usually fit a 10

ohm resistor in parallel with the pot to pass some of the current through a fixed part, making the pot less critical.

From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: RE: [R-390] Replacement Carrier Level Pot.
Date: Tue, 02 Jul 2002 06:25:24 -1000

A bunch years back I squirreled away a handful of 10 ohm ww pots just for this use. I've used a few and have a very limited quantity left (6) but I've decided to dump em and let them get used. They work perfectly as zeroing pots in the R390A. Once zeroed, my carrier meter stays zeroed. These are NOS Clarostat type CM27335 (somebody's part number 140-6109). 1-1/8 inch diameter x 9/16 inch high, screwdriver adjust shaft 5/16 inch beyond the std bushing. The wiper on these is soldered to the case by the mfg which doesn't matter since one end of the original 100 ohm pot is grounded. This ground looks like it can be lifted if it bothers you. But it's worked fine on 3 390As I put them into. Will sell to members here for \$10 each (includes shipping in US).

From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: RE: [R-390] Replacement Carrier Level Pot.
Date: Wed, 03 Jul 2002 06:00:51 -1000

10 ohm pots are all spoken for...

Date: Mon, 12 Aug 2002 21:07:35 -0700
From: Leigh <bipi@att.net>
Subject: [R-390] Line Level VU Meter

I am in the process of refurbishing an R390A. The carrier and line level meters are original and work fine. However, I have a NOS carrier meter (with the correct internal resistance) that I would prefer to use and I am looking for a replacement line lever VU meter of proper physical and electrical characteristics to match this carrier meter. If you have such a meter, I would be interested in purchasing it outright or I would trade the 2 original meters for it. I have posted some photographs of the original and replacement meters on my Web site. The carrier meter is in very good condition but the glass on the line level VU meter is "foggy". They are both made by International. Note that the open viewing area of the NOS carrier meter is larger than that on the 2 original meters, but all other dimensions are the same.

Link to picture of 2 original meters:
<http://home.att.net/~bipi/miscpix/mtrpair.jpg>

Link to closeup picture of original VU meter:
<http://home.att.net/~bipi/miscpix/mtrvu.jpg>

Link to picture of all 3 meters together:
<http://home.att.net/~bipi/miscpix/mtr3.jpg>

Link to picture of NOS carrier meter that I want to match:

<http://home.att.net/~bipi/miscpix/mtrnew.jpg>

The literature I have looked at references a meter resistance for the line level VU meter of around 3360 ohms but mine measures 15.3k ohms on a Fluke 77.

The carrier meter measures 18.1 ohms as it should. So let me know if anyone is interested in an exchange or sale of a replacement line level meter that matches the NOS carrier meter that I have. I guess the other question is if someone knows if these meters can be safely opened to clean the glass? They appear to be sealed. Thanks to all... 73 de Mike K7PI, Mercer Island, WA

From: Buzz <buzz@softcom.net>
Subject: Re: [R-390] Line Level VU Meter
Date: Mon, 12 Aug 2002 21:22:06 -0700

Mike, I have opened many of the "sealed" meters with a special tool that I made. Send me a picture of the back of the meter then I can better tell you if I can open it.

Date: Mon, 12 Aug 2002 21:43:30 -0700
From: Leigh <bipi@att.net>
Subject: Re: [R-390] Line Level VU Meter

Hi Buzz, Thanks for the quick reply... Here are some pictures of the backs of the original meters....let me know if they show what you need to see.

<http://home.att.net/~bipi/miscpix/mtrbk21.jpg>

<http://home.att.net/~bipi/miscpix/mtrbk22.jpg>

<http://home.att.net/~bipi/miscpix/mtrbk11.jpg>

Thanks Again...

From: "Glen Galati" <eldim@worldnet.att.net>
Subject: Re: [R-390] Line Level VU Meter
Date: Tue, 13 Aug 2002 01:41:36 -0700

Hello Mike, I've got a lot of those small meters, however I'll have to study your pictures and compare with our to decipher. I'll post after I have a BRAIN DIGESTION.

From: "scott" <polaraligned@earthlink.net>
Subject: Re: [R-390] Line Level VU Meter
Date: Tue, 13 Aug 2002 06:38:57 -0400

Yep Mike, those International meters can easily be opened. They are plastic not glass and you can easily replace lens if needed. First turn the meter over and pick

out the rubber around the edges. It will come out in one piece. You will see 4 hollow screws at the corners where the mounting screws go through.

Remove these screws and presto! the meter separates from the front. I did this to repaint my meters. Very easy I agree, your NOS meter there is quite a nice unit. Sure would be nice to find a matching pair.

From: DCrespy@aol.com
Date: Tue, 13 Aug 2002 20:17:28 EDT
Subject: Re: [R-390] Line Level VU Meter

Scott, three added comments to the reply below.

1. Sometimes the International meters have left hand (vs normal right hand) threaded screws. If they do not come out easily, try turning the other way.
2. I have found them also with glass lenses.
3. The meters were painted with radioactive material that, in spite of no longer glowing, is still quite toxic. Particles are likely loose inside the housing. Let your conscience guide you on the health risk of opening one up. Protect yourself if you do. That \$80 NOS meter from SSN ----doesn't look so bad, in this context.

Date: Tue, 13 Aug 2002 20:32:46 -0400
From: rbethman@comcast.net
Subject: Re: [R-390] Line Level VU Meter

I don't know how "toxic" radium is after it has gone through several half lives. Is it an alpha emitter? If so, the particles could probably be safely vacuumed out. Alpha particles won't go through paper or unbroken skin, BUT are VERY toxic if breathed in or otherwise ingested.

Date: Tue, 13 Aug 2002 19:03:37 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Line Level VU Meter

If this is a '67 EAC it probably doesn't have hot meters anyway. If its older,..... well, when I was out playing with my Geiger counter I happened to check the speedometer on my 1952 deuce-and-a-half,...WOW was that one HOT!! So-o-o-o, if your radio was built with "hot" meters they are probably still HOT!

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] Line Level VU Meter
Date: Tue, 13 Aug 2002 22:05:56 -0400

> I don't know how "toxic" radium is after it has gone through several half lives.

I read on one website that the half-life of Radium 226 is 1,620 years, so there's a way to go yet. After 1,620, half of the radium remains, at which point the price of the

NOS meter will probably be a few million dollars or whatever currency they'll be using then.

> Is it an alpha emitter? If so, the particles could probably be safely vacuumed
<snip>

I don't know, but we generally recommend against sniffing or eating the meters. The cure could take a while.

Date: Tue, 13 Aug 2002 22:15:12 -0400
From: rbethman@comcast.net
Subject: Re: [R-390] Line Level VU Meter

My 67 EAC glows VERY well in the dark, thank you! My Collins - 52 - Definitely still does. As I dig through my archives - Radium IS AN ALPHA emitter.
Recommendation: DO NOT OPEN original meters. I suspect that this would be VERY detrimental to one's long term existence! Ingestion of alpha particles is not a NICE way to go! Could be replacement meters. They (67 EAC) do NOT have Radium dial faces

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Tue, 13 Aug 2002 22:42:07 -0500 (CDT)
Subject: Re: [R-390] Line Level VU Meter

These appear to be originals (58 date code on one), and the seller of the radio (whom I trust and who is knowledgeable about these things) assured me that they are.

Date: Tue, 13 Aug 2002 23:52:00 -0400
From: rbethman@comcast.net
Subject: Re: [R-390] Line Level VU Meter

Do they glow if light is applied to them for a period of time - THEN look for a glow?

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Tue, 13 Aug 2002 22:59:19 -0500 (CDT)
Subject: Re: [R-390] Line Level VU Meter

Haven't tried that yet.

From: "scott" <polaraligned@earthlink.net>
Subject: Re: [R-390] Line Level VU Meter
Date: Wed, 14 Aug 2002 06:50:04 -0400

> Radium IS AN ALPHA emitter.....DO NOT OPEN original meters.....

I DON'T want to downplay the health risk. But it takes a pretty sizeable exposure before the risk of cancer goes up. We all drink radium in our water every day. Some water supplies are worse than others. Opening the meters is not sure death.

It just needs to be done with caution and with care. Radium sits in our bones and decays producing Radon. Back in the 20's people used to drink radium for it's "invigorating" properties and believe it or not, some of these people were around 50 years later to tell about it. Others who drank a lot, were often not around for more than several years and died of bone decay and cancers. Like an idiot I smoked for 18 years, being quit for 2 years now, and probably did a LOT more long term damage to my body. Not to say that it is OK to just open meters carelessly, but doing so outside and downwind, with a quality partial protective mask, is probably just fine. JUST MY OPINION. Don't sue me for your own stupidity.

Subject: RE: [R-390] Line Level VU Meter
Date: Wed, 14 Aug 2002 10:55:49 -0700
From: "David Wise" <David_Wise@Phoenix.com>

Radium has a half-life in the thousands of years, so if it was hot, it's still hot. The phosphor, however, gets tired and quits glowing, I wouldn't be surprised if a radio-phosphor was also light-storing; you folks who see that aren't off the hook. Since it's an alpha emitter and alphas are stopped by just about everything, your geiger counter will not register through the glass. Alphas may be easy to stop, but if you inhale or ingest a source, it will work on you from the inside for the rest of your life; high risk of cancer. If you open one, it's a good idea to wear a good fine-particle-filtering respirator, do it in a breeze-free place, don't kick up any dust or let a single speck fall on the floor, and treat the tools and debris as low-level radioactive waste.

Date: Wed, 14 Aug 2002 17:23:11 -0400
From: rbethman@comcast.net
Subject: Re: [R-390] Line Level VU Meter

I was simply drawing from memory. I do not remember the half life. I sort of remember that it is an alpha emitter. My concern is folks exposing themselves to an open source of alpha emissions. This is not good practice at all. While some talk about radon exposure, it isn't concentrated as the radium on the face of the meter. Then there is the possible "flakes" or particles inside the enclosure. This should be handled with MUCH care. Any "geiger" counter won't pick up the emissions with even a piece of paper over the particle(s), much less the glass or plastic meter cover/face. If folks, especially us older ones, remember the results of the women working at National Lead whom used to hand paint the faces of meters, they'd give a LOT of thought as to the care they take with this.

Date: Wed, 14 Aug 2002 18:41:50 -0500
Subject: Re: [R-390] Line Level VU Meter
From: blw <ba.williams@charter.net>

I know that a lot of those ladies who painted our radium dials died an early death. They had a habit of wetting the points of the brushes in their mouths. A former factory in New York is still a hot zone after all these years. I would suggest that a no wind environment is the idea place to tinker with radium dials. I did some component changing on a larger clock face a few months back and took precautions. My wife says that she can see me better at night, but I never listen to

her anyway. (g)

From: "Dulaff, Paul" <PDulaff@dpconline.com>
Date: Mon, 19 Aug 2002 14:53:07 -0700
Subject: [R-390] Audio Level VU Meter Specifications

I am quoting a reproduction run of the VU meter for the R390A. The supplier needs the Collins drawing and specifications for the meter. The Collins P/N is 481 0001 00. Any of you folks know how I can get a drawing or the meter specifications ?

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] Audio Level VU Meter Specifications
Date: Mon, 19 Aug 2002 15:09:21 -0700

M102 METER, CARRIER LEVEL: (55026) type no. 182; per (80063) dwg no. SM-C-283216

M101 METER, LINE LEVEL: Flange, panel mountings, (80063) dwg. no. SM-C-283217

From: "Dulaff, Paul" <PDulaff@dpconline.com>
Date: Thu, 22 Aug 2002 15:34:04 -0700
Subject: [R-390] VU Meter Drawing - SM-C-283217

I am investigating sourcing a reproduction VU meter for the R390A. The potential supplier of the meter needs the drawing for the meter in order to complete the quotation process. I understand that a CD of the R390A drawings exists. If anyone can supply me with a copy of the drawing (electronically or otherwise), I could then proceed to investigate the cost of reproduction meters and report my results here. As a side note, my research so far has determined that SSN is now out of stock of R390(A) meters. What was left were NOS replacement meters for the R390(A), but now are gone. I guessing that the source of meters has dried up and that there may be a need for replacement meters of 25 units or so (?) depending upon the price. Again, if anyone can supply the documentation, please let me know.

Date: Fri, 23 Aug 2002 08:34:43 -0700 (PDT)
From: <jlap1939@yahoo.com>
Subject: [R-390] (no subject)

Friends, Short note: anyone need a carrier meter? Have one and would sell very cheap if you NEEDED it..(I replaced it as it was International, and I wanted Simpson... or I would trade... Also still have a nice lg. knob... (clamp, but no screw...) Trade both for what have you, or what do you offer in green stuff...

From: DCrespy@aol.com
Date: Sun, 25 Aug 2002 08:54:02 EDT

One of my R-390A's is running that meter. I installed it. I got it at Fair radio years ago, along with my first R-390A. Unfortunately, I do not know what it came from. It

was a loose meter in one of their bins when I picked it out. I have done side by side comparisons with both used original and correct NOS meters. The meter that you have reads correctly as installed in an R-390A. That is, a 3dB reading on that meter corresponds to a 3dB reading on an original/NOS meter, and so on. I'd clean it up, paint it and use it! If not, let me know, I'd be interested in buying it!

Date: Sun, 22 Sep 2002 18:06:36 -0500
From: Mahlon Haunschild <mahlonhaunschild@cox.net>
Subject: [R-390] International meter disassembly

I have a pair of 1964-vintage R-390A International meters that need to have their bezels re-painted, and I'd like to remove the bezels to do this. It's not obvious to me how the bezels are removed, and I haven't pried up the rubber gaskets yet (for fear of tearing them up needlessly). Can anyone offer some advice on this?

Date: Sun, 22 Sep 2002 22:29:26 -0400
From: Helmut Usbeck <vze2gmp4@verizon.net>
Subject: Re: [R-390] International meter disassembly

To remove the front bezel. Looking at the back of the meter there are 4 slots at the base of the bezel. I use a small screwdriver and tap at slots, top to the left. It should then unscrew easily. No need to mess with the rubber gaskets or remove terminal screws.

From: "scott" <polaraligned@earthlink.net>
Subject: Re: [R-390] IMPORTANT International meter disassembly
Date: Mon, 23 Sep 2002 07:10:35 -0400

The MOST important thing that is what Helm forgot to tell you. OPENING THE METER WILL POTENTIALLY EXPOSE YOU TO RADIUM DUST WHICH CAN HAVE LONG TERM HEALTH RISKS. ONCE YOU INHALE A SPECK, IT SETTLES IN YOUR BONES AND IS THERE TO STAY. The meters can be safely disassembled but you must use common sense.

Date: Mon, 23 Sep 2002 07:17:36 -0700
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] IMPORTANT International meter disassembly

Scott, Sounds like you must have been on the De-Mil board that caused all of the meters to go away. For the record please prove that any one person has ever been hurt by what radiation that might be emitted from any of the metros. You are exposed to more stuff everyday than the meters. Just send me all of the meters and I will keep them out of harms way for another one or two half life periods. You could scrape them and make an omelet and eat it with no harm.

From: "Bob Tetrault" <r.tetrault@attbi.com>
Subject: RE: [R-390] IMPORTANT International meter disassembly
Date: Mon, 23 Sep 2002 08:42:11 -0700

If the population of meter disassemblers were large enough there would be an increase in the incidence of radiation effects. The "for the record..." statement is exactly what the tobacco lobby said.

Date: Mon, 23 Sep 2002 09:50:21 -0600
From: Jordan Arndt <jordana@nucleus.com>
Subject: Re: [R-390] IMPORTANT International meter disassembly

I would think that would depend on someones' tendency towards developing any type of cancer, bone disease, liver problems etc... We are not all the same, and hereditary tendencies can be a big part of the risk. Adding "known" factors into the equation only heightens the risk...Avoiding things that add to the count of factors can only help. Why risk exposure to something that can increase the chance...? Perhaps the level is very low, and in 99.9% of the cases, "Harmless", but disregarding the risk should be left to the individual. Even OA2WA tubes emit radiation, but personally, I'd prefer cheese and mushrooms in my omelete....

From: "scott" <polaraligned@earthlink.net>
Subject: Re: [R-390] IMPORTANT International meter disassembly
Date: Mon, 23 Sep 2002 13:19:38 -0400

I would love to see you do it. Please e-mail pictures. And that is just your humble opinion because you can produce no evidence contrary. Let's get back to the point here...it is not just a short exposure...it will be decaying in your bones for the rest of your life. I am NOT against taking apart the meters, hell, I just did mine. I am for warning people of the potential for hazard. I feel that it is a responsibility we have to tell someone who may be in the blind about possible radium exposure. Let them make the decision how to proceed. Nothing wrong 'bout being a good neighbor.

From: DCrespy@aol.com
Date: Mon, 23 Sep 2002 22:39:55 EDT
Subject: [R-390] Re: R-390 digest, Vol 1 #401 - 8 msgs

If the gasket is the one that is square on the outside to match the meter outside dimensions and round on the inside to match the meter body, you will have to pry it out to get a look at the screws that hold the bezels on. They come off easily, especially if you use a little soap to help it slide off.

The screws are drilled through for the mounting screws, so there will be one at each mounting point. This will be clear when you get the gasket off. Some of the screws are conventional right hand thread, while some I have found are left hand thread! So, if they do not come out easily, try turning the other way!

Finally a caution, the glass and its gasket will not be real secure in the housing, and will likely come loose after the bezel is removed. If you have the radioactive meters, you have to decide how important it is to you and your health to have a perfect paint job. If you have any doubts, I'd just clean it up with windex, as it sits, then mask it precisely and paint.

I hope this helps

Date: Sun, 06 Oct 2002 17:38:25 -0400
From: Dave and Sharon Maples <dsmamples@comcast.net>
Subject: [R-390] R-390A meters

All: I thought Harry's note on the residual radioactivity of the meters was certainly useful to know. He mentioned a \$50 cost-savings figure. Has someone made replacement meters for the R-390A in that price range? If so, who is the company? As much of a pain in the neck a typical meter repair job is (and with such little guarantee of success in the end), \$50 is not anywhere near too much to pay to just replace the things. Presuming that there is NOT an easily-obtained replacement, I'm sitting here thinking about how to disassemble, clean, and reassemble the meters without letting any particulate matter loose. This sounds just like asbestos removal to me, and just about as much fun as a dental drill with no anesthetic!

Thoughts run toward disassembling the meters in a bowl of Freon-TF or similar degreaser, cleaning out the movements, and then sealing up the debris in a suitable container and getting rid of it. Boy, that's a lot of work, and how do I deal with trying to find a place that will handle disposal of potentially radioactive waste (maybe the local radiology or nuclear medicine department at the hospital)? I've got a set of three Harris URC-94 SSB transceivers that use basically the same meter style. Since those are illuminated (and about 20 years newer) I suspect they DON'T have the same problems, but one never knows (sigh). Ah, well, when I was a kid I was the happy recipient of a number of science kits, courtesy of Mom and Dad. One of them had to do with a cloud chamber and radioactivity, and there was a bag of what I believe was pitchblende included in the kit, as well as some film. I never built the cloud chamber, but did manage to leave the bag of pitchblende on top of the film, and as I recall it got well and truly fogged. I have probably had more radioactivity from that than I will ever get from the R-390A meters...

Date: Mon, 23 Dec 2002 10:20:13 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] METERS What To Do?

>...even if they no longer glow, they will still be "hot". Maybe the best route is to just leave >them as is rather than risk inhaling any radium loaded dust. Jon AB9AH

I concur. The radioactive stuff is *some* (not all) meters is harmless if left in the meter. If you injest it, you are at risk for cancer. Morgan's rule for Glowing Meters and voltage regulator tubes with radioactive stuff: DON'T BREAK THEM OPEN AND EAT THE INSIDES. (Or the functional equivalent of trying to clean the inside of the glass)

Date: Mon, 23 Dec 2002 10:20:22 -0500
From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: Re: [R-390] METERS What To Do?

Interesting that this subject has just come up. I'd always wondered about the meters in my

R-390A and older R-390. Last night I'd been doing a little work in the radio room with lights on, then left for a while. I thought to take a small flashlight and go back in (thinking I'd need to charge the radium again) for a look. Well, the room was dark and the meters were glowing well enough that I could see the scale separations. The A model is a Teledyne, so I'm guessing early 60s for it. The R-390 is a Collins, probably early 50s? Whatever the case, the radium is still very active. Don't think I'd care to dig into them for the sake of glass-cleaning, either.

From: "Barry Hauser" <barry@hausernet.com>

Subject: Re: [R-390] METERS What To Do?

Date: Mon, 23 Dec 2002 11:05:36 -0500

> Whatever the case, the radium is still very active. Don't think I'd care to dig <snip>

The radium will be good to go for a few thousand more years, whether or not the phosphorescent paint loses its mojo and fails to glow. I think the deal is this -- the phosphor paint they use now on watch dials, etc. is "charged" with light. In the good old days, the glow-in-the-dark stuff was energized with the mystical atomic rays from the radium that was mixed in with the paint. (Look, Ma ... no batteries!) This way, it would glow 24/7 without need for light exposure.

Reminds me ... like that auto commercial with the cars of the future, according to all those magazines like Popular Science in the 50's. We were also supposed to be unhooked from the power co's by now -- and no need for gas or fuel oil. Yup, down in your basement shoulda' been by now a very small nuclear (not "nucular", dammit) reactor about the size of a toaster providing all the 'lectric and heat you'll need. Only needs to be recharged with more uranium or plutonium every few millennia. You should also have a fallout shelter fully stocked -- just in case something goes wrong with your reactor (or the neighbor's) Sumpin's wrong .. I still have an oil burner down there.

Back to the meters -- if you open them and let the genie out, your hair and teeth won't fall out and you won't develop cataracts -- not immediately. Depending on your age and future plans, you might want to don your lead-lined jocky shorts, or stop by the dentist and ask to borrow that thing they put on you when they blast your head with X-rays -- which I suspect promote tooth decay, gum trouble and hair & teeth falling out, etc. Barry

Date: Mon, 23 Dec 2002 12:27:26 -0700 (MST)

From: Richard Loken <richardlo@admin.athabascau.ca>

Subject: Re: [R-390] METERS What To Do?

The radium is used to activate the luminous paint, if you need a flashlight to make it glow then the paint is NOT radioactive. I repeat, the radium is used to activate the luminous paint - radium is not luminous and luminous paint is not radioactive.

From: AB3L1@aol.com

Date: Tue, 24 Dec 2002 01:20:40 EST
Subject: [R-390] METERS

Did I say that I was going to take these apart? No way. Those babies look fine as they are and considering the age are beautiful. I'll have to make sure my eight year old doesn't get near them. We need to keep the family name going. I better keep this thing in the garage high up on a shelf.

From: "Joel Richey" <richey2@mindspring.com>
Date: Sat, 28 Dec 2002 11:25:29 -0500
Subject: [R-390] carrier level meter

Happy holidays to everone, I just rebuilt a 390A and it works great except for an over active cxr meter, it reads full scale on average signals, AGC action is good and have tried all tubes associated with this ckt to no avail, voltage measurments are good and reciever plays very good other the the meter pegging on average sigs, anyone had this problem before???

From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] carrier level meter
Date: Sat, 28 Dec 2002 11:34:31 -0500

Check the resistor from pin 3 to ground on V506. It should be 27 ohms. Fair Radio changes out this resistor to give their substitute meters enough drive. It's possible your IF deck has had this resistor swapped out in its past life.

From: "Ron H" <rnharsh@attbi.com>
Date: Tue, 31 Dec 2002 11:00:39 -0600
Subject: [R-390] Meter question

Can someone please explain the whole meter thing? First off, why do they remove them? Maybe more important, can I buy "original meters" or at least remanufactured meters with the scale etc. or do I have to use the replacement meters which I understand work well but don't meet the "restored" criteria...

Date: Tue, 31 Dec 2002 12:45:43 -0500
From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: Re: [R-390] Meter question

> Can someone please explain the whole meter thing?

Seems appropriate, almost like we were destined to go here next after the ballast tube flogging? The issue with the original meters in most all the R-390 and 'A' type radios is one of radium paint used to make the meters glow in the dark. Somewhere along they decided to remove the possibility that someone could become ill or die from exposure (Roy is the man for this explanation!), so they decided to remove them before surplussing the units. Then later they decided to just crush them all instead (radios) so a 'clever' adversary couldn't use them against us. Anyhow, many radios ended up hitting the market meter-less for this reason, the ones that survived. As a result, original meters are less plentiful. Simple, right? Well...yes and

no. As far as replacement meters, they are available. As far as original meters, they are as well. But as far as the 'restored criteria' you refer to, please bear in mind that many/most of these radios went through gov't depot maintenance throughout their lives which resulted in the internal modules being swapped out and modules from other radios (made by other manufacturers) being replaced in the unit before shipping it back out. So, depending on the criteria you use for a 'restored' unit, it likely won't matter. Some units never went through this type of a tear-down because they were used in different areas or by specific individuals. Some were even sold to civilians *new*. These radios have all the original modules they were shipped with as a rule, probably having a problem module serviced and reinstalled if the unit failed. Since these radios were not in the same equipment stream as the vast majority, chances are good that they still have their original meters too, though. Probably the original paint, tag, etc. as well. If your level of restoration is defined by this, best thing to do is have an expert on these radios find one for you. They aren't plentiful, but they do exist. If you have one that you want to restore yourself, it depends more on whether you want to use it or display it, as well as how much you want to spend. Since the radio won't likely be restorable to 'factory' condition, why not just get the aftermarket meters? They'll plug the holes and work just fine, and cost less too. If you really want it to 'look' just like it originally did, it'll take more money and perhaps patience, but you can find the meters that were originally installed. I was fortunate to get an R-390 with the meters still in place, but of the two 'A' models I have, one has no eyes!

From: "Ron H" <rnharsh@attbi.com>
Subject: Re: [R-390] Meter question - reply address
Date: Tue, 31 Dec 2002 12:26:43 -0600

Thanks for the info! I am not a purist, just thought it peculiar that most of the R-390s and R-390As that I see FS have no meters. I am no expert but I would guess that you would have to eat a few dozen meters to actually have any ill effects. I've worn a radium dial watch for most of my adult life and I don't glow in the dark yet! Maybe I better check tonight... As usual, if I want pure all it takes is money.... As for the reply address thing the signature with the note about the reply address is attached automagically but I can't post to the list unless I actually change my address to the one that I used to subscribe... I guess it keeps out the spammers... hope so anyway.

From: "Bob Tetrault" <r.tetrault@attbi.com>
Subject: RE: [R-390] Meter question - reply address
Date: Tue, 31 Dec 2002 10:42:50 -0800

Ron, Alpha particles are stopped by the glass or plastic of your watch face. I assure you that your children would deplore your untimely loss should you eat even a portion of a meter face. Exactly when they would feel the loss is a statistical question best answered by the tobacco industry, who successfully argued for years about causality versus epidemiology...

From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: Re: [R-390] Meter question
Date: Tue, 31 Dec 2002 09:27:48 -1000

On the missing meter question, if both were removed at depots there should be an equal demand for both the line and carrier level meters. Is this the case in the real world? As one who tries to recycle those little meters with the 'proper' scale added, the carrier meter is a lot harder to find and duplicate as a drop-in replacement. It's movement is a lot less resistance than your line level one and the replacements I've been able to find. Hence the increasing trend to tweek some of the resistors in the IF deck to allow others to work.

From: "Jerry Kincade" <w5kp@direcway.com>
Subject: Re: [R-390] Cleaning
Date: Fri, 10 Jan 2003 06:27:27 -0600

I definitely qualify as an old salt, Pete - retired from the Navy 22 years ago. Heck, I've probably wrung more salt water out of my socks than most people have sailed over, as the old saying goes. EPA rules do make a difference, I guess. They stocked 1,1,1 Trichloroethane in five gallon cans on my first ship. Nobody knew any better, they thought it was a safe alternative to carbon tetrachloride as a cleaning solvent. Ha.

BTW, I fixed my Line Level meter. It was easy to open (it's not one of the glowing types). The problem was an open 1180 ohm wire wound resistor. Bridged it with a 1200 ohm 1/8 watt carbon film type, works fine now. It's probably not perfectly calibrated any more, but it probably wasn't perfect before. Besides, it's just a VU meter. Thanks for the offer of help on it.

Date: Sun, 09 Feb 2003 19:38:06 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Continuing on the R-390A

Hi, Odd thing about the 10 turn pot modification. You really need a different value pot. Strange but true If you take a look the pot has a 22 ohm resistor across it. When the pot is set to the high end the parallel combination comes out to 18 ohms. The combination is in series with a 680 ohm resistor so it's not like they had to do it to keep anything from burning up. I have checked a couple of radios and have yet to find one that comes up with more than 15 ohms for the combination of the pot and the 22 ohm resistor. Normally they seem to run around 7 ohms or so. If you can get your hands on a 20 or a 25 ohm pot that should improve the situation over the stock part 3 or 4 X. Of course you would have to change the 22 ohm resistor but that's pretty easy to do. Another way to do it would be 5 ohm pot with a selected resistor in series with it. Again you could use a small single turn pot rather than a big ten turn job. Getting the 10 turn pots under the bracket can be a pain.

From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: Re: [R-390] Continuing on the R-390A

Date: Sun, 09 Feb 2003 21:34:36 -1000

Mouser sells a 10 ohm pot that works perfectly. Xicon/Alpha 24mm Wirewound Potentiometer 24MM WIREWOUND 10 ohm Makes zeroing very easy.

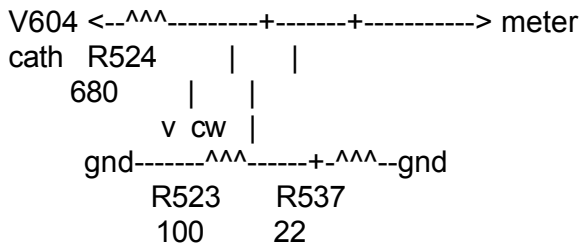
 Subject: RE: [R-390] Continuing on the R-390A
 Date: Mon, 10 Feb 2003 14:08:29 -0800
 From: "David Wise" <David_Wise@Phoenix.com>

Rather than changing the pot (the brute-force approach), I changed the wiring slightly, and got a linear adjustment range with the original pot. If you compare the R-390 with the R-390A, you will find that the former has a 15-ohm WW, while the latter has the 100-ohm carbon || (in parallel with) a 22-ohm fixed. A comment in the Cost Reduction Report says this was a response to the discrete steps of the old WW pot. Retrofitting a WW, even a 10-turn, will bring back the discrete steps unless it's some kind of metal film instead of wound wire.

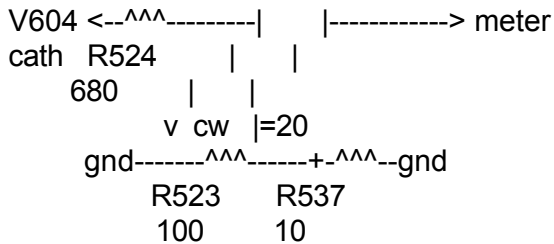
The R-390A arrangement is continuous, but it's also very nonlinear. According to Y2K Figure 5-6, V506A idles with about 100mV at the cathode. V504 cathode is 9V which puts 13mA through the R524/R523/R537 network. To get 100mV (i.e. meter zero), R523||R537 must be 13 ohms, i.e., R523 must be 32 ohms or about 1/3 rotation.

For smaller offsets things deteriorate rapidly. My V506A idles at 60mV instead of 100 . This requires 4.6 ohms total or R523 = 3D 5.8 , which is practically against the stop.

Original circuit:



V604 sees 680 to 700 ohms. The meter sees 0 to 18 ohms, with a nominal value of 13 and in my case 5. What I did:



With this arrangement, V604 sees between 680 ohms and 710 ohms, and the meter sees 9 ohms. Full CCW is 0mV. 1/4-rotation is 30mV. 1/2-rotation is 60mV. 3/4-rotation is 90mV. Full CW is 120mV. You can experiment with various values for R537. Larger values will increase the adjustment range and decrease the reading on strong signals. My meter was overindicating with the original circuit so

10 was about right.

Due to the way they used the bridged terminals, the change requires that you move wires from one to the other. I don't remember the details, but with the manual it's easy to figure out.

Why didn't they go the way I did? My humble guess is that this relatively unimportant part of the job fell through the cracks. They probably had a junior engineer calculate the 22 ohm resistor and let it go at that. This mod can be applied to the R-390 as well as the R-390A.

Date: Sat, 22 Feb 2003 15:20:39 -0600
Subject: Fw: [R-390] R-390Amore AGC
From: windy10605@juno.com

>I still have a problem with the carrier meter repeatability,

Turns out that the meter is "sticky" put another uA meter in parallel and if you slowly turn the adjustment potentiometer up until the other meter reads "x", the carrier meter reads "20". If you turn the pot to full scale and slowly turn the pot down until the other meter reads "x" again, the carrier meter reads "60". I took the meter apart (fun job)that ring with the 4 indentations is NOT threaded into the housing, its just a pressed in soft metal ring. I drilled through one of the indentations and pried the ring out. Will JB Weld it back. Also you can now clean the glass ...I don't know how a sealed meter gets junk on the inside of the glass. The carrier meter "zero adjust" is basically non functional, so I loosened one of the movement end screws a 1/4 turn and the meter now moves freely and the "zero adjust" works. Easier to tune up stuff on the R-390 if the carrier meter works.

Date: Sun, 23 Feb 2003 13:27:05 -0600
From: windy10605@juno.com
Subject: [R-390] Carrier Meter adjustment

The Carrier Meter is a little sensitive to adjustment and I guess that is why some people suggest that it be replaced with a 10 turn potentiometer ...or maybe it's burnt/worn because the majority of the current does not go through the 22 ohm, 1 watt resistor leg, it goes through the much less than 22 ohm setting of the potentiometer. My carrier meter is adjusted when the pot is at about 10 ohms ...not much on a 100 ohm pot range. If you look at the circuit, the 22 ohm resistor and 100 ohm pot are part of the cathode resistance circuit for the 4th IF and I believe the 100 ohm pot was intended as a voltage divider for the meter. The way it's shown in the schematic it will affect the cathode resistance some as you vary the "adjusted pot" valueand it makes adjustment very sensitive. If you move the green/blue wire to the center tap and remove the wire short from the center tap to one end, you have essentially made the pot a voltage divider for the meter and the cathode resistance stays fixed at about 19 ohms (parallel 22 ohm and 100 ohm). Seems to work fine and the pot is much easier to adjust. Haven't found a down side yet.

Date: Sat, 22 Feb 2003 12:39:11 -0600

From: windy10605@juno.com
Subject: [R-390] R-390Amore AGC

I still have a problem with the carrier meter repeatability, crank the RF gain down and back up and you get a completely different reading. Zeroing the meter varies also ...it's OK for a while, then it's off again. Anyone experience that? Got tired of the signal blanking and carrier meter kick when you switch from "Low" to "Med" AGC. Installed a 10V MOV from the AGC terminal screw to a ground screw on the back of the unit. Minimal kick and blanking and no ill effects observed. Would have liked a nominal 10V DC MOV but the smallest one Fry's has is the 10V MOV which has a nominal 18V DC clip level. Lot better than the over -100V spike when you dump the 2mfd capacitor. Zeners were a tradeoff between peak current capability and minimum series resistance. Never found a good match. At least MOVs have no problem with that level of energy.

From: ToddRoberts2001@aol.com
Date: Sat, 22 Feb 2003 13:59:37 EST
Subject: Re: [R-390] R-390Amore AGC

Carrier-level meter drift and non-repeatability is usually the result of a worn-out Carr-Meter Adj pot R523. Many fellows replace these with a 10-turn pot for better settability and stability.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Mon, 24 Feb 2003 17:26:23 -0500
Subject: [R-390] Meter zero and AGC

<snipped> If you move the green/blue wire to the center tap

Making the pot a voltage divider for meter would change meter sensitivity as zero setting is varied. Maybe that wouldn't really matter - to most of us an "S" meter reading is just a relative indication anyway. Some list members have suggested keeping the original circuit configuration but changing 22 ohm resistor to 8.2 ohms. I use that setup and carrier meter zeroing is easy and stable (clean that pot). I, too, have opened up the carrier level meter to reset tension on the jewels, thereby eliminating stiction. I found (on my example anyway) that the four fasteners holding assembly together are tubular nuts and hollow screws with no "persuasion" necessary for disassembly. Jewel tension is easily adjusted after loosening a small jam nut. I cleaned inside of glass with lacquer thinner - perhaps the dull accumulation there is due to rubber gasket outgassing over the years. Caution: meter scale and pointer are usually coated with radioactive radium paint. Take care not to inhale dust. Perform operation outdoors, wipe up dust with damp cloth and dispose of appropriately. Scraping the paint and using some to decorate cookies whilst snorting the rest for a new kind of high is right out. On AGC time constant switching voltage spike and "The Moment of Silence": some have used a 24 volt zener to limit AGC line voltage and have reported it to be effective. The 2 diode fast attack / slow decay AGC (Dallas Lankford) modification is also a fairly good remedy.

Date: Sun, 23 Mar 2003 22:35:24 -0800
From: ronald j deeter <k6fsb@juno.com>
Subject: [R-390] meter repair

the amount of knowledge this group has is tremendous. best not to reinvent the wheel..... I think someone had posted a method of getting inside the metres?, I have been able to repair metres when i can get into them. I have two that I'm unable to access.

METRE 1. EAC - steel rear/aluminum front bezel and Looks like an aluminum threaded collar on the rear of metre bezel holding the movement case? is it, isn't it---- solutions?

METRE 2. Simpson Bakelite case has 8 screws on front of case, looks like a rubber(?) gasket under the glass. the glass will not pop out with pressure on the glass with the loosened movement from the rear. it is like glued down (too many years of compression). Thoughts on this one?

Date: Mon, 24 Mar 2003 02:10:37 -0800 (PST)
From: Mark Donaldson <wa1qhq@yahoo.com>
Subject: Re: [R-390] meter repair

I have disassembled both types with success, the unit with the threaded collar is indeed as you described, I use a pair of needle nose pliers as a wrench inserting one nose into each of the collar slots and then twist on the handle of the pliers to unthread the collar, they are seldom torqued in very hard so it should be easy. On the other meter this is a tough one and has to be approached very carefully. I use the tip of an exacto knife to wedge under the meter glass and work my way around to loosen the glass from the surface it is attached to, there isn't much room to work the blade in and some glass chipping can be expected but will not show up when the bezel is back in place, the secret to making this work is to use a heat gun on the the glass to try to break down the adhesive. All the usual precautions apply use eye protection and don't inhale radioactive dust. No guaranties that you won't make the meter worse than when you started but I assume the meters are already defective so nothing ventured nothing gained.

From: "Jerry Kincade" <w5kp@direcway.com>
Subject: Re: [R-390] meter repair
Date: Mon, 24 Mar 2003 06:29:21 -0600

It can be done if you are lucky and careful. I was able to resurrect a dead line level meter - one of the two little series wirewound resistors inside was open, and I paralleled it with a 1/4W metal film unit that was very near the same resistance, meter now works fine. Probably no longer calibrated with any precision, but I can't tell any difference in normal use, so what the heck. A better idea calibration-wise might have been to select another exactly matching resistor and replace the good wirewound at the same time, but inherent laziness took over.

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>

Date: Mon, 28 Apr 2003 07:12:47 -0500
Subject: [R-390] Refinishing meters

Has anyone experience with meters like the one shown at <http://members.aol.com/n4buq/r390a>

I want to have it powder coated, but I'm not sure putting it in a 400-deg. oven is a good idea. Does it come apart? It appears to have a hard-rubber (neoprene?) gasket imbedded in the back. Does this come out easily? If so, does it expose the method of disassembly? I noticed that when I removed the electrical connections on the back, the meter movement became loose inside the housing. Apparently this isn't a sealed meter and it should come apart but I havent seen any way to get it apart....and, no, I don't plan on licking the insides of the meter...

From: "Scott, Barry (Clyde B)" <cbsscott@ingr.com>
Subject: RE: [R-390] Refinishing meters
Date: Tue, 29 Apr 2003 07:34:45 -0500

Sweeeeet! I thought the thru-holes looked like they had inserts, but I didn't figure they were threaded. Thanks.

Date: Tue, 29 Apr 2003 08:38:45 -0400 (EDT)
From: "David P. Goncalves" <dpg@coe.neu.edu>
Subject: [R-390] Re: Refinishing meters

>removed the electrical connections on the back, the meter movement became loose

Question: Does the joint between the circular case and square face have a recessed metal ring with 4 notches in it? A couple of meters I received yesterday have that, might need a special wrench to unscrew it, if it does indeed screw in. It could also be a friction/compression ring; if so I guess drilling into the notches would help. Just a guess. Also: I was reading in the 'Pearls' about the solution of the meter face reproduction problem (using a laser printer). I'd like to make a couple of Fair Radio replacement meters into useable R390 meters, but to do so, I need either a scan or high quality photograph of the two dial faces. Does anybody have these?

From: "Scott, Barry (Clyde B)" <cbsscott@ingr.com>
Date: Tue, 29 Apr 2003 08:02:13 -0500
Subject: [R-390] Re: Refinishing meters

This one has four shoulder screws that hold the round back to the square face. I didn't see this until I removed the thick gasket. I'll get a picture on the website tonight (unless I forget...)

Date: Tue, 29 Apr 2003 09:30:44 -0400
From: "Gregory W. Moore" <gwmoore@moorefelines.com>
Subject: Re: [R-390] Re: Refinishing meters

To ALL, I could generate some artwork for the meter faces, but what I would need is a photo of an actual glowing R390 meter face with a machinist's scale in the photo... I want to do the artwork large, then have it reduced in a process camera. I need the machinist's scale in the pix to establish actual size...I would appreciate being able to see the mounting screw holes for the meter face, etc.....I have an R392 from Fair with a replacement meter, so I can use that as the benchmark for the "new" meter, in case screw holes have changes, etc, etc. If you can do this, I will do a layout of the artwork, and get it shot in the process camera to reduce it.. Hey, I KNOW that this is kinda behind the times, but we didn't use CAD/CAM or computer rendering when I was designing dials for aircraft instrumentation..we did the original anywhere from 4:1 to 10:1 using pc artwork layout tape for the indicia, cut to exact size with my trusty X-Acto, and a photo typesetter of the old strip type, so one cut the lettering out and pasted it up... The bigger the better, as scale errors were reduced in the reduction process. Now, on printing the meter face, I recommend using either Randolph epoxy Fed-Std 595 color 37038 (flat black) yes krylon flat black would work, or flat black baking laquer from Brownells, and to screen the indicia, a 600x600 mesh stainless screen using Ulano Wet Direct Emulsion.... the printing, I can find no better than Wornow Cat-L-Ink flat white (17875) unless you want a different color..color. I am not really set up here for this type of precision screen printing, since I am now retired from aerospace engineering, but I could do the artwork, if asked nicely enough --hi-- I will suppose that someone on this list has the ability to do the whole layout by computer graphics, so if they do, you have my greatful thanks, but if you want it done "the old way" I will do the artwork, get it reduced with the emulsion on the right side to expose the screen printing plate, and then ya are on your own...these are just suggestions....

Date: Tue, 29 Apr 2003 09:22:31 -0500
Subject: Re: [R-390] Re: Refinishing meters
From: blw <ba.williams@charter.net>

I used to do the same thing you are suggesting by hand back in the '70s. However, it seems that a good grade of real silk would be better since you will probably be doing only a few prints and not hundreds. Silk will hold up for this. Maybe steel mesh is better for other reasons, I dunno. Never used it, but high grade silk was amazing. Also, why not just shoot the screens on Rubylith? I bet a good arc light system and a high grade emulsion will get the details of the dial faces pretty good. This saves cutting the Rubylith like you suggested. I can cut screen material and friskets just as well as anyone else, but not that kind of thing with dial arcs and numbers. Just a suggestion from a former commercial artist from the dark ages. (g) By the way, keep in mind that you will probably have to tile the same image on the mesh/silk so that one pull would produce maybe 10 or more dial faces. That is a lot of precision cutting unless you shoot the screen.

Another approach would be easier, more accurate, and certainly cheaper. Look at Hobbytown or any other R/C hobby supply source and see about decal paper. I read about it several years ago. It is a paper and you can 'print' your own decals on this special paper and run it thru the printer. It produces the same decals like we used on plastic model kits. If this stuff is still available, I bet a clear full sized decal with black print would look nice on a white painted metal dial plate. The white arcs

and numbers would show thru and probably look very good. Just another suggestion.

From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: Re: [R-390] Re: Refinishing meters
Date: Tue, 29 Apr 2003 05:56:44 -1000

If your meter has the ring in the back with the 4 notches you can remove this with a good pair of long nose pliers. This ring is threaded on. Just put the pliers in a couple of the notches and twist CCW. The other type of meter has the threaded inserts from the rear through the mounting holes. These just unscrew with a wide, thin standard screwdriver. With both types the rubber is probably sticking pretty good from all those years of compression. I don't think a rubber adhesive was used. I have done both scanned and CAD drawings from both meters onto hp glossy photo paper using a laser printer and they come out looking real good. I remove the dial scales from the meters and carefully glue this new scale onto the back side of the existing scale. Trim all with a sharp razor and you have a perfect match using the existing holes. If you ever want 'original' again, just flip the scale over. BTW, I just don't do one scale on each sheet of paper. With the computer you can copy 16-20 of the same on each which gives you many years of meter scales. If anyone wants to see the artwork I use I could send you an email of it. My originals are in Visio but I could convert it to jpg or pdf. Another thing, these meters are so small, really, that a minor imperfection on the artwork really becomes minor when reduced to full size. Some original meters I've seen have had really horrible silk screening, printing, or whatever method they used.

Date: Tue, 29 Apr 2003 10:50:08 -0700 (PDT)
From: John Kolb <jlkolb@cts.com>
Subject: Re: [R-390] Re: Refinishing meters

Back in the dark ages (about 1958), I got a shoebox of commercially made decals from one of the local hams. As well as the sets of words for receivers - Bandswitch - Bandwidth - RF Gain - etc, there were several sets of decals of meter faces. various sizes, black on white, white on black, 0 to 3, 0 to 5, 0 to 10 markings, etc. I guess there used to be lots of meter reuse.

Date: Tue, 29 Apr 2003 20:02:13 -0500
Subject: Re: [R-390] Re: Refinishing meters
From: blw <ba.williams@charter.net>

Back in the later dark ages I got a large pack of Letraset press type transfers that were mostly electrical terms. I have it somewhere, but I'll probably use some of those "on" and "volume", etc words one day. I'll cover them with a small square of clear laquer. I should start digging around to find that pack. It is neat.

From: Buzz <buzz@softcom.net>
Date: Tue, 29 Apr 2003 21:23:02 -0700
Subject: [R-390] Meter faces on the web

Since there has been a lot of interest in R-390 meter faces I decided to put my library of meter faces in the public domain at: <http://webs.lanset.com/buzz/meters/faces.html> There are meter faces there for R-390, R-392 and the GRC-106 amp. Also, there was interest on the Mil-Veh mailing list re: using 12 volt lamps on 24 volts so I made up a page to help with those projects at: <http://www.softcom.net/users/buzz/12to24/1224v.html>

I hope that you enjoy, Buzz

From: "Scott, Barry (Clyde B)" <cbsscott@ingr.com>
Date: Wed, 30 Apr 2003 08:13:22 -0500
Subject: [R-390] Meters

I updated the website with pictures of the back of the Line Level and Carrier Level Meters. Anyone have meters like these? I would like to get a matching set and wonder if anyone wants to do some trading. <http://members.aol.com/n4buq/r390a>

From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: Re: [R-390] Meter faces on the web
Date: Wed, 30 Apr 2003 05:31:45 -1000

Good beginning Buzz. However, your picture is for the Vu Line Level meter rather than the carrier level stated. If others have trouble opening the picture, try changing the .tiff suffix to .tif.

From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: Re: [R-390] Re: Refinishing meters
Date: Wed, 30 Apr 2003 05:34:43 -1000

Those rub on decals were made by MarKit and Chartpak which I also still have. Packages were made for words and dial markings, both black and white. Age seems to be drying them out and less able to stick to panels.

Date: Tue, 29 Apr 2003 19:01:30 -0700
Subject: Re: [R-390] Re: Refinishing meters
From: ronald j deeter <k6fsb@juno.com>

David- make yourself a wrench from conduit or copper pipe, i used a piece of copper pipe (i think 1.5") and filed the end to make the tabs (used only three tabs) to fit the back of the metre, put pipe in vise and then unthreaded the collar, movement can be removed after removing the nuts on the back holding solder lugs.
Ron

Date: Wed, 30 Apr 2003 14:12:47 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Re: Refinishing meters

Would-be Meter Disassembles, I have the urge to repeat Morgan's Law of Radioactive Meters and Regulator Tubes: tu wit: DON'T BREAK THEM OPEN AND EAT THE INSIDES.

To elaborate slightly:

1) SOME meters from R-390's and other radios have glow-in-the-dark meters containing alpha-emitting radioactive sources. (Even though it does not glow anymore, the stuff is still in there.)

2) Many military OA2 and similar regulator tubes have small amounts of radioactive material in them to ensure reliable ignition especially in the dark and cold.

In both cases (pun intended!) the stuff is pretty harmless unless you get the case open and get the material on you or inside you (by breathing or ingestion or through a cut or abrasion). Make sure this does not happen! What does "pretty harmless" mean? I remember one analysis that concluded something like: You would have to place an R-390A meter on your chest or cheek for about 34 years before you'd be exposed to radiation equivalent to the minimum yearly radiation exposure. However, ingestion or inhaling the dust from a meter's markings or tube innards places the material in direct contact with your tissues and could lead eventually to cancer or the like. A sealed meter or unbroken regulator tube envelope effectively contains all alpha emissions. The bottom line: If you are going to take R-390 meters apart: Make VERY sure you know what kind of meter you have and what you are doing. Roy

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Re: Refinishing meters
Date: Wed, 30 Apr 2003 13:15:34 -0500

Good [repeat] advice. One of the meters (Carrier Level) is marked "Sealed -Do Not Open" while the other (Line Level) is not marked as such. I wonder if the Line Level meter would be considered "safe"? I haven't opened either of them, partly because of the radiation thing. I have noticed that the Line Level meter doesn't appear to be all that well sealed (see pictures) so I'm thinking it may not be a threat. What think ye?

Date: Wed, 30 Apr 2003 14:34:30 -0400
From: "rbethman@comcast.net" <rbethman@comcast.net>
Subject: Re: [R-390] Re: Refinishing meters

Simple folks. IF the meter is an ORIGINAL, it's markings are RADIUM. Radium may NOT still glow, BUT, it has a half-life in the OVER a thousand year range. One of Radium's by products is Radon gas. BOTH are Alpha emitters. An alpha particle is the easiest to stop, BUT - is also the one that does the MOST damage. Why else do you think that all the R-390As sold by Fair Radio only can be bought either with replacement meters or without meters at all? The government was REQUIRED to dispose of them as Radioactive Waste. A very good friend of mine, KA4SFV, is now a silent key. He was exposed to Alpha particles thanks to nuclear testing. The effects take a LONG TIME to get you, unless you get a very healthy dose. I am NOT opening any original meters. If someone has a GM counter - like an Eberline 500, if you get the chance, AND want to take a chance, remove the cover from the front of

a meter - open the window on the bottom of the GM counter and PLEASE send us the resulting readout.

Date: Wed, 30 Apr 2003 14:37:15 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] Re: Refinishing meters

Many harmless meters are in fact "sealed" and are not intended to be opened for repair. I would not depend on the marking "Sealed do not open" as an indication one way or the other that the thing contains any radioactive material. Instead, I suggest you do two things:

1) Become familiar with the visual appearance of the radioactive markings. (Yellow-ish, thick, indistinct edges, may appear to have been dobbed on the surface over existing paint markings.)

2) Look at the meter in the dark, complete darkness, after you have also been in the dark for at least 15 minutes to allow your eyes to adjust.. Also, try this after exposing the meter close range to the sun, or to a flourescent lamp (preferably a cool white one). This may "re-charge" the glowing material a bit.

>the Line Level meter doesn't appear to be all that well sealed (see >pictures) so I'm thinking it may not be a threat.

I don't know if the meters that have radioactive markings were sealed or not. Will folks who know the nature of their meters comment on this please?

From: "Scott, Barry (Clyde B)" <cbsscott@ingr.com>
Subject: RE: [R-390] Re: Refinishing meters
Date: Wed, 30 Apr 2003 13:38:30 -0500

Yes, I've opened meters marked "Sealed" and realize this was designed to keep contaminants out, not to keep bad stuff in. I think both the meters on my Motorola are original as they have the markings you describe. The "newer" Carrier Level meter (pictured on my website) doesn't appear to have as thick a film on it as the other meters. The Line Level pictured does appear to have it. I have not been able to detect any glow-in-the-dark effects from any of these meters, but I may not have given my eyes enough time to adjust. I'll give it another try -- particularly after "charging" one of them in sunlight.

From: "Scott, Barry (Clyde B)" <cbsscott@ingr.com>
Date: Wed, 30 Apr 2003 13:55:52 -0500
Subject: [R-390] Meters...

One more thing on the meter issue. One thing I noticed when I pulled the Line Level meter was that it is made such that removing the screws that connect the wire lugs to the meter effectively "open" the meter. Removing both screws caused the innards to flop around and I noticed holes in the back where the screws used to be. If this is a "hot" meter, this certainly exposed its contents. Just an observation.

Date: Wed, 30 Apr 2003 15:09:53 -0400
From: "rbethman@comcast.net" <rbethman@comcast.net>
Subject: [R-390] Meters - more

Roy and I aren't scare mongers. We just both have a concern for fellow boatanchor enthusiasts. Here is a quote from doing a lookup on Radium half-life:

> Radioactive Decay & Half-life

>

> Half-life is the period of time required for radioactive decay to reduce the
> inventory of a given isotope to half of its initial value. Decay is spontaneous,
> without any outside stimulus. The decay rate does not vary, so some isotopes
with long half-lives will be around for millions of years. Half-life is a key parameter
in strategies and engineered structures for treatment and safe storage of
radioactive wastes. Compared with the 1600-year half-life of
>radium-226, caesium-137, cobalt-60 and iridium-192 have half-lives of 30 years,
5.3 years and 74 days respectively.

Date: Wed, 30 Apr 2003 15:25:22 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Meters...

More meter madness ... I did that also -- there's a tendency to want to remove those funny screws (really some kind of cap-nut) so as to solder onto the terminals without heating up the meter terminals. However, those cap-nuts are part of the meter mounting and seal -- at least to keep dust out, as well as to keep the "genie" in the bottle. However, I don't think you need to take the radiation cure. As I recall, alpha travels in straight lines, doesn't take corners well. It would have to get around the meter face, the mechanism and make its way out through the holes. Always amazes me that radiation is both a cause and a cure. When I was an infant, they hung a radium amulet around my neck (told this story before) to treat an enlarged thyroid gland -- a condition they later found cures itself. Nowadays, there's a relatively new treatment for enlarged prostate -- radioactive "seed" implantation. They put in a seed or two -- radioactive pellet -- for a while, then take it out. Pretty good success rate with little or no collateral damage or side effects, so they say on the radio. So, when my time comes, I'm not gonna pluck down a fortune for a dumb seed implant. I'll just put a meter scale my jockey shorts. Of course, when I finally get a full checkup, the doc will say "Barry, your prostate seems fine, but the x-ray turned up this arc shaped mark with a some numbers around it -- all backwards!" Like wimmen -- radiation -- can't live with it, can't live without it.

From: "Scott, Barry (Clyde B)" <cbsscott@ingr.com>
Subject: RE: [R-390] Meters...
Date: Wed, 30 Apr 2003 14:31:02 -0500

Barry (TIO), I was more concerned about any dust that might have fallen out of the holes. I wonder if that's why the military simply cut the wires instead of unscrewing the lug nuts. I figure it was a time-saving measure but I wonder...

Date: Wed, 30 Apr 2003 16:35:20 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Meters...

>Anyone else have meters that came with stickers like this?
><http://users.rcn.com/r390a/hobby/line-level-rad.jpg>

Not here, but that picture gives some idea of the thick, rough-surfaced, yellow appearance of the needle and graduations that I referred to in my earlier message.

Subject: Re: [R-390] Meters...
From: Richard.McClung@Dielectric.spx.com
Date: Wed, 30 Apr 2003 17:02:02 -0400

Yes, I took mine apart and rinsed them off in the sink, I think I used bleach and ammonia to help clean them up. It worked real good, too. I don't need a night light in the kitchen anymore because the sink drain glows in the dark....I put the labels on the neighbors door bell buttons.....

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Date: Wed, 30 Apr 2003 16:10:08 -0500
Subject: [R-390] Meters

I think this has been covered before, but I don't recall. Given the Carrier Level meter is a 1ma full scale meter, can any old 1ma full scale meter be used? Same goes for the Line Level meter (not sure of the full scale is for that one). Other than the scales and the physical size, is there something characteristic about these meters that make replacing them all that difficult?

Date: Wed, 30 Apr 2003 14:15:16 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Re: Refinishing meters

The meters on my '67 EAC simply are NOT radioactive. Now, the speedometer on my '52 GMC Deuce-and-a-half is one hot sumbitch!

Date: Wed, 30 Apr 2003 17:19:18 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Meters...

Yup, just like that one, on each meter.

Date: Wed, 30 Apr 2003 14:33:46 -0700
From: Robert Simpson <_bobs@pacbell.net>
Subject: Re: [R-390] Meters...

Found Radiation Hazard Warning regarding radioactive material in an addendum to TM 5820-238-20

Audio Level Meter	6625-00-669-0769	RA 226	0.69uCi
Audio Level Meter	6625-00-669-0770	Ra 226	0.40uCi

Electron Tube 0A2WA 5960-00-503-4880:

EEVC	U 328	0.1uCi
CBS Hytron	Ni 68	0.5uCi
Raytheon	Co 60	0.2uCi

Seems there is a need for caution when working with any of these.

Date: Wed, 30 Apr 2003 14:57:09 -0700 (PDT)
From: jparker@onemain.com
Subject: Re: Re: [R-390] Re: Refinishing meters

From an old submariner:

Alpha isn't too bad.
Beta a little worse.
Gamma even worse.
Neutron, call the relatives and say goodbye

Characteristics of Alpha Radiation

1. Alpha radiation is not able to penetrate skin.
2. Alpha-emitting materials can be harmful to humans if the materials are inhaled, swallowed, or absorbed through open wounds.
3. A variety of instruments have been designed to measure alpha radiation. Special training in use of these instruments is essential for making accurate measurements.
4. A civil defense instrument (CD V-700) cannot detect the presence of radioactive materials that produce alpha radiation unless the radioactive materials also produce beta and/or gamma radiation.
5. Instruments cannot detect alpha radiation through even a thin layer of water, blood, dust, paper, or other material, because alpha radiation is not penetrating.
6. Alpha radiation travels a very short distance through air.
7. Alpha radiation is not able to penetrate turnout gear, clothing, or a cover on a probe. Turnout gear and dry clothing can keep alpha emitters off of the skin.

Characteristics of Beta Radiation

1. Beta radiation may travel meters in air and is moderately penetrating.

2. Beta radiation can penetrate human skin to the "germinal layer," where new skin cells are produced. If beta-emitting contaminants are allowed to remain on the skin for a prolonged period of time, they may cause skin injury.
3. Beta-emitting contaminants may be harmful if deposited internally.
4. Most beta emitters can be detected with a survey instrument (such as a CD V-700, provided the metal probe cover is open). Some beta emitters, however, produce very low energy, poorly penetrating radiation that may be difficult or impossible to detect. Examples of these are carbon-14, tritium, and sulfur-35.
5. Beta radiation cannot be detected with an ionization chamber such as a CD V-715.
6. Clothing and turnout gear provide some protection against most beta radiation. Turnout gear and dry clothing can keep beta emitters off of the skin.

Characteristics of Gamma Radiation and X-Rays

1. Gamma radiation and X-rays are electromagnetic radiation like visible light, radio waves, and ultraviolet light. These electromagnetic radiations differ only in the amount of energy they have. Gamma rays and X-rays are the most energetic of these.
2. Gamma radiation is able to travel many meters in air and many centimeters in human tissue. It readily penetrates most materials and is sometimes called "penetrating radiation."
3. X-rays are like gamma rays. They, too, are penetrating radiation.
4. Radioactive materials that emit gamma radiation and X-rays constitute both an external and internal hazard to humans.
5. Dense materials are needed for shielding from gamma radiation. Clothing and turnout gear provide little shielding from penetrating radiation but will prevent contamination of the skin by radioactive materials.
6. Gamma radiation is detected with survey instruments, including civil defense instruments. Low levels can be measured with a standard Geiger counter, such as the CD V-700. High levels can be measured with an ionization chamber, such as a CD V-715.
7. Gamma radiation or X-rays frequently accompany the emission of alpha and beta radiation.
8. Instruments designed solely for alpha detection (such as an alpha scintillation counter) will not detect gamma radiation.

9. Pocket chamber (pencil) dosimeters, film badges, thermoluminescent, and other types of dosimeters can be used to measure accumulated exposure to gamma radiation.

Date: Wed, 30 Apr 2003 18:06:25 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Meters

Yes -- it has been covered, but nothing is ever resolved forever. Also, it's more humane to beat dead horses than live ones. Anyway, as I recall, the DC resistance or is very low for the correct R-390 carrier meters -- something like 14 ohms or maybe 11? Resistance varies for other 1 ma meters, but is typically much higher. To make a different meter work with reasonable deflection calls for changing out 2 or more resistors in the IF deck (part of a bridge circuit.) My understanding is that Fair Radio has been doing that to get some replacement meters working. Also, as I recall from the thread, Dr. J. and perhaps others had cautioned against putting an ohmmeter directly across the meter terminals. There was a procedure for measuring DC resistance without burning out the armature coil. Probably can find it in the Pearls of Wisdom on Al's R-390A FAQ site.

Date: Wed, 30 Apr 2003 18:24:19 -0400
From: "rbethman@comcast.net" <rbethman@comcast.net>
Subject: Re: [R-390] Re: Refinishing meters

The alpha is why there is an issue IF the meter is opened. So long as it is enclosed there is NO danger. When one begins taking meters apart to change, clean, or alter the face/dial, THEN there is an issue. Army nukes never did trust bubbleheads!

Date: Wed, 30 Apr 2003 22:02:55 -0400 (EDT)
From: "Paul H. Anderson" <pha@pdq.com>
Subject: Re: [R-390] Meters

R-390/R-391/R-390A carrier meters are 1 MA FS, 17 ohm, as far as I know. R-392 meters are 27 ohm, again as far as I know. I'm sure there is some variation. I was lucky to snag a small bunch of 5.6 ohm 1MA FS meters, which just need a small inline resistor to approximate 17 ohms. Some of the Simpson 100 ohm 1MA FS meters have an internal shunt resistor that can be bridged, giving a new resistance that is much lower. The meters are radioactive, and you should be careful, but it ain't plutonium. I remember having some radioactive isotopes in my 7th grade science class.

Date: Wed, 30 Apr 2003 20:25:53 -0700
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] Meters...

What a bunch of worry warts. How many 1,000's of guys were around them for 50 years and "DO YOU KNOW OF ANY STERILE OR MIS FORMED OLD OPS?" No way. I flew over the AEC test site for 2 years in Airborne Radiation Monitoring

Service (ARMS) wearing a dosimeter to measure 4 different forms of radiation plus all of the instruments in the aircraft with never an excessive reading on the bi monthly dosimeter checks. I can assure you that there is no way to exceed the annual allowed M-roetgin (sp) readings. My ROLEX wrist watch has a tare count of 185 Mr on a 18" photomultiplier tube used for setting ZERO prior to flight and then an hour flying over our calibration site near Pahrump, NV to ZERO the plane prior to tracking a leakage event and or tracking all on the nuclear sites in the USA. So send me all of you hot bad meters and let me clean and store them in all of my 30 plus R-39XX radios. This has been covered numerous times. Please show proof of damage from meter exposure PERIOD

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Re: Refinishing meters
Date: Thu, 1 May 2003 08:29:52 -0500

Well, I got quite a surprise last night. I got the room completely dark and looked at the meters. Nothing. A minute passed. What's this? A faint glow?? Several more minutes passed and to my surprise, all four meters glow! It's faint, but it's there. Presumably the stuff they coated it with that did the actual glowing is all but gone but they still do glow however dimly. I had tried this before, but I didn't wait to let my eyes adjust. Very interesting. Is it possible these are not radium-caused effects but simply a process that absorbs light and then glows for a while? I doubt it... I plan to do some photography (the camera should pick up what my eyes don't). Thanks for the info.

Date: Thu, 01 May 2003 09:51:37 -0400
From: "rbethman@comcast.net" <rbethman@comcast.net>
Subject: Re: [R-390] Meters...

The issue ISN'T simply the meters. The issue is OPENING them and getting inside them - thereby exposing the material DIRECTLY to the individual. I am VERY well acquainted with the missions you were involved in. Worked for AEC for seven years myself, plus eleven years of reactor operations, maintenancs, and refueling. The issue is alpha particles, while being the easiest to block, are the MOST damaging to the internals of the human body, i.e., ingested or inhaled. As long as you USE the meters in their designed cases - YOU will have NO PROBLEMS. This whole thread HAS BEEN REGARDING opening the case, and working on them or even removing the dial face. In regard to exceeding the max annual allowed dosage level - you can't do that even by working on the insides. BUT - would you care to inhale dust from plutonium, uranium, OR radium? That is the topic.

From: "Tom-WB3AKD" <wb3akd@arrl.net>
Date: Thu, 1 May 2003 10:02:54 -0400
Subject: [R-390] Meter Radioactiity

Hit them with some black light. They'll really shine then, even when you turn off the UV. While this does not insure that they are radioactive, it'll prove that it's more than just paint. My CDV-700 shows the Carrier level meters on the R-390's emitting about half the rate of the test source on the side of the counter (I'll have to dig

around and see what that comes out to be as the test source has weakend over the yearsw) , and the line level meters emitting quite a bit less. The R-390A (EAC) emits nothing that I can measure. These were measured by putting the probe right up against the front of the meter fase with the window on the probe open. Meters were not disassembled. The R-392 also emits weakly. For comparison, I've got an old Kollsman altimeter that puts out about as much as the test source and an Elgin Aircraft clock that emits nothing I can measure through the glass. Durn, I'm gonna have to set up the cloud chamber and see what this altimeter's sending out. Think I'll move it off the desk.

Date: Thu, 01 May 2003 10:07:54 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Meters

> There was a procedure for measuring DC resistance <snip>

In Summary:

1) Arrange a source of voltage with a current limiting resistor to make the meter read full scale. 1-1/2 volt penlight cell and a 1500 ohm resistor, for instance, would work for a 1 ma meter movement. If you use variable resistors, make sure you don't over drive the meter.

2) While the circuit is operating, put resistors in parallel with the METER until it reads half scale.

3) The value of the parallel resistance is equal to the internal resistance of the meter.

Note: R-390A line level meters are AC detecting and include an internal rectifier. They will deflect upwards with applied voltage of either polarity. Their resistance is likely non-linear to some degree, but the above method will give you an approximation of the overall meter-plus-rectifier resistance.

Date: Thu, 01 May 2003 10:00:57 -0700 (MST)
From: Richard Loken <richardlo@admin.athabascau.ca>
Subject: Re: [R-390] Meter Radioactiity

> Hit them with some black light. <snip> Quite correct, and Once more with feeling! It is not the radium that glows, it is the harmless luminous paint. The radium is expected to stimulate the molecules in the paint to make them glow so that you do not have to depend on outside light sources to get the paint all hot and bothered. The totally evil news is that the luminous paint has pretty well lost its ability to glow (no matter how well it is stimulated) but the radium is doing just fine thankyou very much and it will be just fine for centuries to come. It is because of things like these uninformed conversations that the government remvoed the damn things. Stop giving the safety freaks a boost up like this!

Date: Thu, 1 May 2003 16:02:02 -0400 (EDT)

From: "David P. Goncalves" <dpg@coe.neu.edu>
Subject: [R-390] Re: Meters...

Yes, the R-390 meters may be radioactive, but what about the PRC-47 meters that Fair radio has been selling as replacements? I sat in my closet for a half hour (live in the city, only room that gets dark enough) waiting for a glow. Nope, none. As for the meter dials, I'm thinking of taking the digital scans mentioned and having a print shop make me some custom adhesive labels. Just peel, stick, and reassemble. Simple: Have the scans printed out onto a adhesive paper, either black on a white paper, or white on black paper. Cutout labels by hand. I'm told this is very cheap, and can be done at a Kinko's or Copy Cop. Advanced: Have labels made with raised print (like on a business card) with white ink onto a flat black adhesive label material. Have labels laser-cut to fit the removable dial plate (including screw holes). I like the 'advanced' option. If I get those made, I'll send an e-mail and offer the extras to all the people who have the PRC-47 meters.

From: "Bryan Stephens" <mail08458@pop.net>
Subject: RE: [R-390] Meters...
Date: Thu, 1 May 2003 04:21:23 -0400

Yes. Two of my R-390A's (Collins ~1955 and EAC ~1968) had little radiation stickers on the VU meter. I bought the Collins from a surplus dealer in Memphis c. 1988, and the EAC was from Fair c.1995.

Date: Fri, 2 May 2003 17:19:58 -0700
Subject: Re: [R-390] Re: Refinishing meters
From: ronald j deeter <k6fsb@juno.com>

Ok folks- I'll take all the radio active metres, no problem in dealing with them. I regularly deal with far worse. Seriously folks use common sense! this applies to more than just the metres. Think first.. if you are only doing a few , no big deal, but do take some simple precautions like keep it off your skin (like use gloves latex or nitrile) and work with a slight air flow across the work area. don't play with it , fix it and reassemble it. some of the simpson metres with the bakelite case, the glass is recessed and the rubber seal has glued itself to the case and the glass. To open it I machined four 1/8 inch slots one on each side so as to get a "prybar" under the glass. Be careful and patient. Ron, K6FSB

Date: Sat, 03 May 2003 10:13:40 -0400
From: "rbethman@comcast.net" <rbethman@comcast.net>
Subject: Re: [R-390] Meters - Back Lighting

I don't think it will work. I have similar meters from aircraft. The dials/faces are metal. You'd have to figure a way to cut a slot in the top center of the cylindrical portion and use a build very similar to the veeder-root illumination ones.

Date: Sat, 03 May 2003 11:02:25 -0400
From: "Gregory W. Moore" <gwmoore@moorefelines.com>
Subject: Re: [R-390] Meters - Back Lighting (an expensive proposition)

The question is could R390 meters be backlit--- YES
Is the process feasible for the average restorer-NO

Reasons" to backlight something, one either has to have the substrate of a plastic material, either polycarbonate or plex, have room for lamps at the rear, then go thru a multitude of painting and etching steps to create the indicia on the meter. While the result is truly outstanding to look at, the process is both labor and \$ intensive.

Ok, how about edgelit or prislit lighting, same problems...one puts the lamp (s) at the top, then designs a prism to properly refract the light over the dial face, and this prism is NOT the dial face itself, it resided behind the glass face. Again, very doable but also labor and \$ intensive for a "one-off" project. Basically, to do either of these options, one would be designing a entirely new meter (except possibly for the movement), and tooling up for the case and all the other goodies from scratch.

Option 3 (Electroluminescent)...same answers, sure, its very doable, and one can get EL material in a variety of shapes..but the cost of getting the indicia on the EL material would be prohibitive...(Darn, they look good though)

I used to design these things for aircraft use, and , trust me on this, you would NOT BELIEVE the pitfalls and roving groups of alligators one finds themselves facing. Once the design is finalized, and you have one working, properly lit, model produced, you have expended a huge chunk of capital, invented much project-specific tooling, and are on the way to a full blown ulcer.

I hope these comments help... Frankly, I would love to see a well backlit meter in either an R390 or R-392, but it just wouldn't be viable for the quantity we have to work with.

From: ToddRoberts2001@aol.com
Date: Sat, 3 May 2003 13:25:18 EDT
Subject: [R-390] R-390 Meters - Front Lighting

I was thinking that possibly a way to light up the R-390 meters would be to light them from the front. A small hood could be fashioned from a piece of aluminum that would only have to stick out maybe 1/4 inch from the front top of the meter face. It could be fastened to the meter with 1 of the top mounting screws and the other hole left open to feed one wire thru the front panel and tie in with the original lighting circuit (the other wire would be grounded to the chassis via the screw holding the hood to the meter).A small grain of wheat bulb would fit nicely inside the hood out of sight and shine a light directly down onto the meter face. If it was done well it would look good and only slightly change the appearance of the front panel. The hood could be painted black on the outside to match the meter and left reflective on the inside. If it didn't turn out right just take it off, put the other screw back in the meter and you are back to original. 73 Todd Roberts WD4NGG.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] Meters - Back Lighting (an expensive proposition)

Date: Sat, 3 May 2003 11:33:44 -0700

How about using the new white LEDs? Perhaps a red one too to warm up the color a bit. Or a green one to simulate the original phosphor emission. One or more could be mounted inside the meter case and could be expected to live there a while. Don't know what the radioactivity would do, though. OTOH, do you really want to modify a R-390, especially meters? I still need a signal strength meter for the club R-390A if anyone has a spare. ;^)

Date: Sat, 3 May 2003 15:01:22 -0400 (EDT)
From: <ah7i@atl.org>
Subject: [R-390] R-390 meter s and luminous paint, source

Buy some fresh luminous paint and fix 'em that way! It's about \$10 plus ship. -
bob

Date: Sat, 03 May 2003 17:08:37 -0400
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] R-390 Meters - Front Lighting

You might try picture lights. These are the long bulb lights frequently seen over paintings. They have a top shield that can be used to direct the light and keep it from shining in your eyes. With a low watt bulb they are perfect for illuminating a flat surface.

From: DCrespy@aol.com
Date: Sun, 4 May 2003 08:44:42 EDT
Subject: Re: [R-390] Meters - Back Lighting

I got the meters with "factory backlighting" out to photo for a list user. I found they were a little different than I'd described. There is simply a hole in the housing (rear surface near the top). Everything else is handled in the plastic gadget that attaches to the back. The gadget is held in place with extended meter terminal screws. The bulb inserts from right to left into the gadget as viewed from the rear of the meter. There are two terminals at the top for the lamp connections. The right hand of these two terminals swings out of the way for lamp removal. I do now have a decent JPEG for any one interested. Harry KG5LO

Date: Sun, 04 May 2003 09:47:03 -0700
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] Meters - Back Lighting

Grimes Co. makes eyebrow lights for the aircraft industry in all sizes. plus light assemblies for backlit panels. Which are a whole new can of worms to get into. Due to the inherent frugality of hams most will have cardiac arrest with the sticker shock. I have made full aircraft panels using Grimes systems. I think in the 60's when we did this panel for a Lodestar it was over \$15,000. Hank KN6DI

From: "Bob Tetrault" <r.tetrault@attbi.com>

Subject: RE: [R-390] Meters - Back Lighting
Date: Sun, 4 May 2003 17:26:45 -0700

I was Chief Engineer at a competitor in LA back in late 80's early 90's. Grimes was notorious in new airframe programs in providing gratis an entire shipset of lighting for prototype and safety of flight. They'd invariably get the initial contract but default or charge 10X the original quote when it came time for actual production. We'd usually get the second source contract and it would turn into the whole enchilada after a while. I've got strobes flying on much of our military inventory: AV8B, FA-18E/F, F-14D, F-15 something, S3B, stuff in the B-2 and F-117, C-130, P-3, etc. Grimes or Sheldahl couldn't deliver, we could. And yes, the pricing for that kind of stuff would make most hams go into shock. Imagine a little dimmable fluorescent using those little 6W tubes selling to Northrop for 1200 dollars. Real cost wasn't too far off, either. S rated components, Tempest certified, documentation out the wazoo. We'd build twenty per year... Among other things. We also made widgets.

Date: Sun, 04 May 2003 20:39:58 -0500
Subject: Re: [R-390] Meters - Back Lighting
From: blw <ba.williams@charter.net>

I remember elbow lights. The red ones were crappy, but got better when they went to blue-green lighting. Those little things never worked good. The trim ball in the OH-58A/C did not have lighting. We always used the mini cyalumes to light them.

Date: Mon, 05 May 2003 17:37:27 -0500
From: Terry O'Laughlin <terryo@wort-fm.terracom.net>
Subject: [R-390] Grimes - Back Lighting

I have a sizable collection of LTV gear with Grimes backlighting. It works very well. Most of the LTV gear is repackaged Watkins-Johnson/Communications Electronics, Inc. gear except for the G-133 which is a repackaged Collins 51S-1. LTV took the WJ/CEI gear and made front panels of translucent material and silk screened them with a negative of the front panel (no paint where lettering occurs). Thus the labels light up in a black panel. The panels don't wear well, every paint nick lights up, but they sure look cool in the dark. The overall effect, when combined with the tactical knob tops (different shapes for different functions) makes for a really cool radio. It seems to me that Grimes system panel could easily be made. A sheet of plexiglass or lucite drilled for all the controls, meters... could be spray painted black. Then the letters could be added using a pantograph or CNC like the ones you see at hamfests for making name tags. Then all you need are the little Grimes light fixtures.

Date: Mon, 05 May 2003 21:00:32 -0400
From: Gene Beckwith <jtone@sssnet.com>
Subject: Re: [R-390] Meters - Back Lighting

With diligent scrounging...one can find meters with lighting already designed it.... the ones I found were 1ma. movement if I recall....Haven't used them in the 390X's but know the format is out there and would take some shunting and bridges to

adopt...but would be really cool in that one of a kind built from parts 390

Date: Tue, 06 May 2003 08:16:33 -0700
From: "W. Li" <wli@u.washington.edu>
Subject: [R-390] Re: R390 panel meter resistance

A few days ago, a msg appeared about measuring the internal resistance of a R390 panel meter, employing the classical method of getting a full-scale deflection using a 1.5 volt battery and a pot; and then adding shunting resistors to get half-scale deflection, and concluding that the shunt resistance reflected the internal resistance of the meter. This method appears in all ham and radio manuals, and it shall be referred to as the "traditional" method. The traditional method is clearly described below, and is what we were all taught. <snip>

>1) Arrange a source of voltage with a current limiting resistor to make the meter read full scale. 1-1/2 volt penlight cell and a 1500 ohm resistor, for instance, would work for a 1 ma meter movement. If you use variable resistors, make sure you don't over drive the meter.

>2) While the circuit is operating, put resistors in parallel with the METER until it reads half scale.

>3) The value of the parallel resistance is equal to the internal resistance of the meter.
<snip>

Now, if you think about it, this time-honored method results in false results, because by adding the shunt resistor across the meter, you actually LOWER the total resistance of this simple series circuit... and thus INCREASE the total current flow, thus falsely altering the deflection of your R390 meter. A fresh battery is really a constant voltage device, and not a constant current device. One workaround is to keep this series test circuit current constant. This method involves a second mA meter. Insert any low mA meter (say a 2 mA one) into the circuit, then connect your R-390 panel meter IN SERIES with it and your battery and pot. Now adjust the pot to get full deflection of the R390 meter, and note the reading on your 2 mA meter. Remove your R390 meter, and substitute a 10-turn precision 500 or 5000 ohm pot, and adjust it alone to get the ORIGINAL READING on your 2 mA meter. Now the resistance of the 10-turn pot is exactly the same resistance as the internal resistance of the R390 meter, since under this scheme the test circuit's current was kept constant.

So to get down to real-world data: (using my meters)

carrier meter = 14 ohms (traditional); 28 ohms (actual) 1 mA full-scale

line meter = 2600 ohms (traditional); 3500 ohms (actual)
250 uA full-scale and is an AC voltmeter in reality

I'd like to take credit, but this subject was already discussed in some detail in the 73

Test Equipment Library volume 1 (1976) pp33-35.

Bottom-line: this is all academic if you are able to find original meters for your unit, but is of some importance in the case you want to adapt non-R390 meters.....

From: "Bob Tetrault" <r.tetrault@attbi.com>
Subject: RE: [R-390] Re: R390 panel meter resistance
Date: Tue, 6 May 2003 09:03:44 -0700

Not only is it published in the reference noted, but it has been the method published in almost every ARRL Handbook I've ever read, from '64 when I was first ticketed to the present.

Date: Tue, 06 May 2003 15:40:00 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Re: R390 panel meter resistance

>A few days ago, a msg appeared about measuring the internal resistance of a R390 panel meter,

That was me.

>Now, if you think about it, this time-honored method results in false...

Quite true. Lets take an example.

1.2 volt AA cell, normal R-390A Carrier meter.
Quoting "Paul H. Anderson" <pha@pdq.com>:
"R-390/R-391/R-390A carrier meters are 1 MA FS, 17 ohm, as far as I know."

So for one ma current with 1.2 volt supply we need a total circuit resistance of:
 $R = EI = 1.2 \times .001 = 1200\text{ohms}$. The fixed (or adjustable) resistor then needs to be 1200 - 17 ohms or 1183 ohms.

As a first approximation, when the 17 ohm meter is paralleled with a resistance of equal value the resulting resistance will be 8.5 ohms, and the total circuit resistance will be $1183 + 8.5 = 1191.5$ ohms. This will in fact increase the deflection of the meter by a factor approximating $1200 / 1191.5$, or about 1.007. That is seven tenths of one percent. This is tiny.

I say "first approximation" because the method asks you to set the parallel resistor for half scale deflection. Thus the resistance you set will be just enough smaller than the resistance of the meter to compensate for the tiny increase in circuit current due to the overall reduction of total circuit resistance.

>A fresh battery is really a constant voltage device, and not a constant current device.

I agree. The battery is unlikely to change voltage much due to either discharge or

change in circuit current. However, the circuit described above is approximately a source of constant current, at least to less than one percent change.

>One workaround is to keep this series test circuit current constant.....

This is a basic method of substitution, and is all very fine, but: (I am assuming the circuit is similar to above with a 1.2 volt source and a limiting resistor.) The change in circuit current with the R-390 meter replaced with a short will be approximately 17/1200 of the original amount. By shorting the R-390 meter, the 2 ma meter's needle will deflect approximately 1.5 percent higher. If the R-390 meter is replaced with approximately twice it's internal resistance (34 ohms) the 2 ma meter will deflect about 1.5 percent less. Determining the resistance that causes the 2 ma meter to return to it's original deflection will be quite difficult. Mechanical sticking will likely make it impossible. A digital multimeter with 4 or more digits in current mode would make it quite easy to do. If a higher source voltage is chosen with correspondingly higher series resistance, the changes in mechanical deflection of the 2 ma meter as the substitute resistor is adjusted will be proportionately less. A 9 volt battery, for instance, and 9 K resistor will cause the change in deflection to about one seventh as much, or 0.2 percent.

>I'd like to take credit, but this subject was already discussed in some
>detail in the 73 Test Equipment Library volume 1 (1976) pp33-35.

Here are some factors to consider as you ponder the fine points of the method that the 73 Test Equipment Library suggests:

- 1) Many meters normally used by Hams have higher internal resistance than the R-390 series meters. The 73 Test Equipment Library method was likely developed with these higher resistance meters in mind.
- 2) As the the internal resistance of a meter becomes a higher portion of the overall circuit resistance (as with meters of higher resistance), determining the value if the substitute resistor gets easier.
- 3) Lower supply voltage will have the same effect. The meter resistance and the substitute resistor value, will be greater with respect to the overall circuit resistance.
- 4) As the supply voltage gets higher, the current source more nearly approximates a perfect source, and is more immune to small changes in circuit resistance. This will make the 73 Test Equipment Library method more difficult to use without digital current meters.
- 5) Many meters, even good ones, have mechanical hysteresis and resistance that would hide changed deflection due to small changes in current.
- 6) The width of a graduation line in a normal panel meter may be about one percent or less of the total scale length. The width of an R-390 Carrier meter graduation is about 1/40th of the scale length or about 2 percent. The needle is about the same width in some meters.

7) Most R-390 type meters cannot be set to mechanical zero, thus making it difficult to set mid-scale if using the "traditional" method.

Date: Tue, 06 May 2003 16:22:19 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] Re: R390 panel meter resistance

>Not only is it published in the reference noted, but it has been the method
>published in almost every ARRL Handbook I've ever read,

I just happened to have a 1989 ARRL Handbook handy and despite no luck with the index I found the method on page 25-2. It differs from the method outlined by Mr. Li as follows:

Mr Li suggests: "...adjust the pot to get full deflection of the R390 meter, and note the reading on your 2 mA meter. Remove your R390 meter, and substitute a 10-turn precision 500 or 5000 ohm pot, and adjust it alone to get the ORIGINAL READING on your 2 mA meter."

In the 1989 Handbook method, the circuit has

- 1) a series meter able to measure the full scale current of the meter under test
- 2) a series resistor adjusted for full deflection of the meter under test
- 3) a parallel resistor adjusted for half deflection of the meter under test
- 4) the series resistor adjusted to return the total circuit current to the original value.

Steps 3 and 4 are done alternately to arrive at both half deflection and original total circuit current. The resistor in parallel with the meter is then measured and taken as equal to the meter resistance. A 1.5 volt battery is mentioned as an example with no discussion of the effects of different source voltages. It seems to me that this method accounts for all significant variables and effects, assuming the battery voltage is constant enough.

Date: Wed, 07 May 2003 21:16:21 -0400
From: Dave and Sharon Maples <dsmapes@comcast.net>
Subject: RE: [R-390] Re: R390 panel meter resistance

All: Very good point, but I'd add one other piece to this. At the point that you set the two meters in series for a full-scale reading on the R-390 meter and note the current on the other meter, instead of disconnecting and finding a 10-turn pot, why not just read the voltage across the R-390 meter at that point, and then apply Ohm's law to figure out the meter resistance:

$R \text{ (meter resistance)} = E \text{ (voltage across meter)} / I \text{ (meter current)}$

From: "AI2Q" <ai2q@adelphia.net>
Subject: RE: [R-390] Re: R390 panel meter resistance
Date: Thu, 8 May 2003 09:36:51 -0400

Why not use a DMM (never a VOM!) and simply measure the internal resistance directly. Works like champ using a Fluke 8020A.

Date: Thu, 8 May 2003 10:19:10 -0400 (EDT)
From: "David P. Goncalves" <dpg@coe.neu.edu>
Subject: [R-390] Painting Notes and Parts

<snip> 3. Leeds Electronics (www.leedselect.com) seems to be selling a Dejur 100 microamp meter (\$6) in the 1.75" square case most desired for replacements. They also have IERC shields in stock too. If they are reasonable in price, don't buy too many, I need some!

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Meters
Date: Thu, 8 May 2003 09:50:11 -0500

Okay, we can figure out the internal resistance. Now, assume I find a 1ma fs meter that has an internal resistance different from what I need. Is it possible with a combination of series and parallel resistors to achieve the 17-ohm (or whatever it needs to be) resistance to make it swing full-scale and appear to have 17-ohms in the circuit? I assume so but I don't like to assume...

From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: RE: [R-390] Meters
Date: Thu, 08 May 2003 05:49:03 -1000

Ahhhhh, therein lies the problem! This meter only requires 17 millivolts across it to achieve full scale deflection. This makes it a very sensitive meter. Typical meters of this size are higher resistance and require 60-100 millivolts or more for full scale deflection. You can get the right resistance or current but getting them both together is what makes these meters 'special'. One trick used is to get the right resistance with a shunt and use a small DC amplifier on a piece of perf board to drive the meter to get the right current. But then, this isn't 'original', is it?

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Meters
Date: Thu, 8 May 2003 10:52:39 -0500

Not original, but better than two big holes in the front panel :) Anyone been there / done that? I seem to recall someone doing this. If so, can you repost?

Date: Thu, 08 May 2003 12:10:48 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] Meters

Yes but it won't be full scale one milliamp any more. If you find a higher sensitivity meter (say 100 uA) movement with higher resistance you may be able to make a resistive network to make it behave properly (one ma and 17 ohms)

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Meters
Date: Thu, 8 May 2003 11:16:06 -0500

That's what I was thinking. Assume a 0.1mA meter (100uA) with internal resistance of 100 ohms. The parallel resistor should be 1/10 the internal resistance so put a 10-ohm across it. The new "internal" resistance will now be 0.11 ohms. Put a 16.78-ohm resistor in series and it seems this would be an equivalent meter. Is this wrong?

Subject: RE: [R-390] Meters
From: Ed.Hopton@checkpt.com
Date: Thu, 8 May 2003 13:45:22 -0400

Barry is almost right: Put an 11.11... ohm resistor in parallel with the 100 ohm, 100 uA meter. Put a 7 ohm resistor in series with the meter/11.11 ohm resistor combination. The composite network will have a resistance of 17 ohms and the 100 uA meter will read full-scale when 1 mA flows through the 7 ohm resistor.

Date: Thu, 08 May 2003 14:18:05 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] Meters

I think the parallel resistor would be one ninth of the 100, actually, but close enough. (So that nine tenths of the one ma goes through the resistor and one tenth or 100uA goes through the meter.) The equivalent resistance of the 100 ohm meter and a 10 ohm resistor in parallel will be $(R1 \times R2) / (R1 + R2)$ or 9.09 ohms. Then you'd need $17 - 9.09 = 7.91$ ohms in series with that combination. Note that Mr Li reported measured values about twice the expected 17 ohms.

No doubt a clever person could develop a curve or family of curves to tell you the values you'd need to make this work with meters of various internal resistances and full scale currents. I would expect a parabola or some thing like that. And, regions of "it won't work" values could also be plotted.

Date: Thu, 08 May 2003 23:50:31 -0400
From: Gene Beckwith <jtone@sssnet.com>
Subject: Re: [R-390] Meters

The amplified meter gambit has been discussed in "Solid State New" a few years back, complete with a picture of the mounting system on per board. But yes, it has been done before...and opens the door to comparatively easy metering up of those 'pure' rigs with the big holes in them... Keep an eye on the boxes under the tables gents...the meters are out there...and are very usable...as are occasionally the back lighted meters...about half of those found are center scale meters so not as usable... For the purists out here...My five of my R-390X's are up an running now, some are with all original metering, some with mixed meters, and one with mixed meters that is documented "original retro fit by the Navy under at sea conditions....that don't match...one white face (dB) and one black..." So whatever pure is...enjoy...but don't

get your shorts in a knot over it . . . In fact, no one has ever seen my R-390X stable and been able to tell whether my paint jobs are new out of the box or re done, or some with battle scares and like wise for the metering, or the now customized dial skirts...on my favorite ST. J Blue...with it's freshly machined shaft clamps...that are 'not original'...

Date: Fri, 09 May 2003 09:55:54 -0700
From: "W. Li" <wli@u.washington.edu>
Subject: [R-390] Re: panel meter resistance

One caveat: be sure that you measure the maximum current put out by your DMM on the ohms function before you measure your unknown meter. My Fluke 8120B put out only 350uA with the leads shorted on the 0-200 ohm setting, so it was safe to measure directly the internal resistance of a R390 carrier 1000uA meter. But if I wanted to measure the resistance of a 50uA meter with an estimated resistance of say, 1200 ohms, my DVM put out 950uA on the 0-2000 ohm setting, 14uA on the 0-20K ohm setting, and 14uA on the 0-200K ohm setting. Clearly, it would be foolish to use the 0-2000 setting, but safe to use the 0-20K or 200K settings. YMMV of course,,,,,

From: "Scott, Barry (Clyde B)" <cbsscott@ingr.com>
Subject: RE: [R-390] RE: CHEAP DVM \$2.99
Date: Fri, 9 May 2003 12:58:03 -0500

Is the the meter to use to check the panel meter resistance? >;-)

Date: Fri, 16 May 2003 10:38:09 -0400
From: "Gregory W. Moore" <gwmoore@moorefelines.com>
Subject: [R-390] Radium dials and 3AT7 'unubtanium" ballast tube--query for the group

Forgive me if I bring up a subject (Ballast Tube replacement with solid state components) for probably in excess of 10 to the 6th power (LOL, I couldn't figure out how to do superscript in a Netscape web browser), but it does seem as if this is rather a touchy subject, and many modifications have been proposed to retrofit R390/A's with other methods for B+ control, etc. Ok, Query (Flaming, comments, mobs with burning torches parading in front of my house are welcome LOL).

Now, here's my proposal:

A. There are one heck of a lot of these fine receivers out there.

B. Oneless one is lucky, most of what is available on the open market has had the meter removed becuse some unnamed environmentalist brought up the fact that the original meter dials have a dial which was made luminiscent with a Radium (RA-86). IMHO, there are too many environmental zealots running around like chicken little about this... Radium is an ALPHA emitter, and since alphaparticles can be stopped by a simple sheet of paper, the dial face along with a sealed meter case is more than enough to protect anyone from what is a "hyped" radiation

warning.

Consider that I have spent innumerable hours on watch leaning back against one or more R-390(A)'s while in the good ol' USN, and have suffered no ill effects, I, personally don't see the problem. Even if one were to open the meter case for repair, minimal safety equipment would be indicated (a respirator, latex (or non-latex if you are allergic), and some clothes that one wouldn't matter disposing of (not really necessary, but in today's world of liberal created "this has got to have round corners and dull, non harmful edges" it might be prudent, at least the protective mask, and a good source of ventilation with an exhaust hose which could be near the work, containing a filter (gauze is OK) to prevent any dust, radioactive or not, from remaining in the area. forced air ventilation might be a good idea (look at an aerospace laminar flow workstation for an example). Now, I am seriously doubtful if the dial is the bad part in the meter, the failure usually is something wrong with the movement itself, so there is a very infrequent need to have to actually touch the dial face, and if you do, so what, just wash your hands and exposed arms a few times, and the problem is gone. I have done enough rambling for this overdiscussed topic, but it leads in to the next, and that is the power of group purchasing. IF enough of R390philes were to desire meter faces, I can't see for the life of me why we could not recreate the dial via screen printing, using a 600X600 wire mesh screen, or even an 800 mesh. One uses an original dial as a template, creates a 4/1 photo master at one's drafting table using layout tape and photo imaging for the large initial indicia, and reduces it in a process camera. The resultant negative is cut to fit a positive location jig which will hold the meter faces in absolute position using the cut-out for the movement and small drill rod pins for the screw holes, this jig will make the dial fit flush with the surface of the dial, and will hold it in absolute position. One then paints the dial with the lightest coat of epoxy or non-solvent affected paint, bakes until the paint is cured. At that time, the indicia from the screen mentioned above, are screened on to the surface (yes, it is necessary to have a 3axis table with micrometer drive to line the whole shooting match up, but once the sets are completed, and the registration is dead on the money, My own recommendations, based on my career in aerospace, specifically instrumentation design has led me down this path numerous times, and when one is subject to nitpick inspection every step of the way, since I worked for a NASA subcontractor, one works any bugs or alligators out of the mix early on, and the dials are examined under a 25X loupe or microscope, so they better be right.

For Materials, I suggest either Wornow Cat-L Ink© for the white indicia, and either the same in flat black (opnote: the black isn't really flat, and it is necessary to add a "flattening agent" to the mix in a blender or at least a beaker mixer (the one with the magnetic stirrer) to get the mat'l significantly flat enough.. For those who are thinking of airbrushing matte clear (same mfg) over time, fagedaboutid (LOL) the matte yellows (learned during a disastrous period in 1976), or, as a much better black, Dulac Flat Black Lacquer and if that is also unobtainium. good 'Ol Rust-Oleum in flat black is acceptable.. You will have to locate the Wornow Cat-L- Ink in flat white (FED STD 595) 17875 Use a good screen, mount the jig on a 3-axis table, register, and then print to one's heart's content. Note, if you have an oven specify the heat cure catalyst (The temp has to be 80C) but you will find that once you have baked the black it is absolutely permanent, without the use of an epoxy stripper such

as Epco-Strip (warning, if you splash this stuff on your legs, pour vinegar immediately and carefully walk to a decontamination shower...this is from personal experience. The red scars look lkind of neat once one gets use to them LOL, and this incident was back in the 70's. Before I go into meters, if anyone would like additional information, please email me B/C so the discussion doesn't degenerate into a painting and marking thread [huge evil grin).

Once you have gone to the trouble, you are basically in buisness, and are able to produce as many dial faces as one desired, for any meter that is needed. The only requirement is what I have named above, and at least one dial for use as a template for the artwork,. DO NOT USE THE METER FACE ITSELF AS A TEMPLATE, most of the one's I have seen are pure scrap, and wouldn't pass any inspection either incoming or outgoing, including the Gov't, basically meaning they should have been rejected and tossed back into the bin for complete rework,
<snip>

From: "Richard Biddle" <theprof@texoma.net>
Subject: Re: [R-390] Radium dials and 3AT7 'unubtanium" ballast tube--query for the group
Date: Fri, 16 May 2003 18:42:21 -0500

Once upon a time, way back in 1997, Mr. Thomas W. Bowes, KK8M, put togetheran R390/R390A meter kit. It consisted of two surplus meters and, the really neat part, stick on decals with A++ grade meter scales. These look much better than the originals. I tried to contact him last year but the email address I had didn't work. If he still has the art work and the desire, perhaps someone could resurrect the project.

Date: Sun, 18 May 2003 10:49:52 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Radium dials and 3AT7 'unubtanium" ballast tube--query for the group

Tsk Tsk -- you really should make it your business to read ALL of the posts. Priorities, man! Anyway, the meters were made by a variety of manufacturers like Dejur, International, Simpson, etc. There were a lot of meters made in the same form factor, but with different construction methods. Chances are, if you've seen more than one R-390 or R-390A, you've seen more than one mfr's work. The carrier meter and the audio meter in a particular receiver may have come from different sources. Somehow doubt if you will find a catalog listing for something that's in production. Some years ago, I think a list member looked into getting more meters made up and it was either impossible or the cost would be out of sight. There are some NOS meters around, but most are not electrically correct -- higher DC resistance, etc. Also, I think that general case style was pretty much mil only. Not sure. Don't know about the squech circuit, except that the non-A, and R-391 comes with one built in. So, question might be, how many R-390/391 owners actually use the squelch much. I've only used it when checking to make sure it worked.

Date: Tue, 27 May 2003 06:10:05 -0700 (PDT)

From: David Goncalves <my_black_shoe@yahoo.com>
Subject: [R-390] R-390 Meter Faces

Time to pay back for the help... I took the Visio and JPG files of R-390 carrier and line meter faces from a list member, and did a bit of tweaking just to see what I could get to fit my meters (PRC-47 replacements from Fair). Thus, for those who are interested, please take a look at:

<http://www.coe.neu.edu/~dpg/R390Face.vsd>

Do mind, this is a 1.4M Visio file, and it requires the software to view it. The bonus for those with the Visio software is that you can edit it - how do you think I did this? The Visio viewer is available as a download from Microsoft. I've yet to try this out on adhesive material, but the test sheet from a color laser printer looks nice. Maybe the "DB" is a little thin. Any comments? I'll be converting it soon for all to enjoy. Thanks to all who helped out, and sorry that I couldn't name you right now. I promise I will soon.

Date: Tue, 27 May 2003 11:58:21 +0100
From: "David P. Goncalves" <dpg@coe.neu.edu>
Subject: Re: [R-390] R-390 Meter Faces

Credit for the source material goes to Pete Wokoun, Sr. He was nice enough to send me and couple other list members his images from his work on a new, clearer VU meter. All I did was do some cutting and pasting to make it fit the old dial face.

Date: Thu, 12 Jun 2003 20:26:30 -0500
Subject: Re: [R-390] Want to Borrow: Meters
From: blw <ba.williams@charter.net>

Go for it if you can get a reasonable good scan. The relief from meter face to dial looks to be about 1/8". What I'm offering to do is use that scan as a background to work over. I will redraw everything over the scan. It may turn out perfectly correct if the scanned proportions are right, and it is not too fuzzy. Fuzziness means the letters bleed out too wide. Some of this depends on the type of scanner you use. If you wish, send me the file if you decide to do this, and I'll do my best to get a clear background image to work over. This used to be my job so I like doing this sort of thing from time to time.

Date: Thu, 12 Jun 2003 20:52:13 -0700
From: Buzz <buzz@softcom.net>
Subject: Re: [R-390] Want to Borrow: Meters

I put the R-390 line level meter face up some time ago at: <http://webs.lanset.com/buzz/meters/faces.html>
click on the meter you want to get the high dpi scan.

From: "Bruce H. McIntosh" <scotsman@afn.org>
Date: 02 Jul 2003 12:04:41 -0400

Subject: [Collins] 75S-3 S-meter acts oddly; also STBY/OPR no difference

When the unit is first powered up, the S-meter pegs to the right. After the unit warms up, turning up the RF gain causes the meter reading to decrease until, with the RF gain all the way up, the meter reads S0. It never deflects for signals received. The other difficulty is that there is no apparent difference in the unit in STBY or OPR; in either position the rig is "all the way up", with audio coming out the speaker.

Date: Wed, 02 Jul 2003 12:02:54 -0500

From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@isunet.net>

Subject: Re: [Collins] 75S-3 S-meter acts oddly; also STBY/OPR no difference

When interconnected with a transmitter, the receiver has to be in STBY to let the transmitter mute it. OPR overrides the transmitter muting. If not connected to a transmitter, then not muting in STBY can be a hint that there's a short in the mute connector or circuit. The S-meter pegging is probably normal at power up, especially if the RF gain is backed way off. The RF gain control injects a lot of negative voltage into the AGC line and the S-meter is just a simple one tube VTVM (giving a second use to an IF tube) showing AGC voltage. No S-meter reading on signals can mean no AGC and should lead to distorted signals from too much signal at the detector or last IF stage. No AGC can come from a bad tube (detector) or excessively leaky black beauty AGC bypass and time constant capacitors or from the AGC being turned off manually. At least some of the S-line had provisions for turning AGC off. Be sure the S-meter is not deflecting negatively. That is a sign of an IF tube (or more than one) driving the AGC line positive from grid emission. Cured by tube replacement.

Date: Wed, 2 Jul 2003 10:26:17 -0700 (PDT)

From: kwylow zinjanthropus <catman351@yahoo.com>

Subject: Re: [Collins] 75S-3 S-meter acts oddly; also STBY/OPR no difference

Double check that S-meter adjustment pot. In fact, if you have a can of Deoxit, spray that pot and "cycle" the control at both endpoints and readjust. See if that helps.FWIW.

Date: Sat, 05 Jul 2003 10:57:37 -0400

From: Barry Hauser <barry@hausernet.com>

Subject: Re: [R-390] New 390A owner & fan

<snip>>but these look so new and un-marked that I suspect they are repros.....Probably. Most originals are either (a) missing or (b) dented and scratched with some smashed in louvers.

From: "John Page" <k4kwm@hotmail.com>

Subject: Re: [r-390] Strange R-390 problem

Date: Wed, 20 Aug 2003 01:43:20 +0000

Kinda like the problem I just fixed in my R390A. Working great and all of a sudden

the carrier meter pins max right. The terminal of the carrier adjust pot that goes to ground just took a notion to fall off after 50 years. Go figure. Had a junk IF chassis and used the pot off it. Works fine again. Did take a little while to find the problem though. Sure do like those voltage and resistance charts. Made it a lot easier for me as I am still quite the novice on these receivers. <snip>

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Date: Fri, 22 Aug 2003 10:38:41 -0500
Subject: [R-390] Visio Meter Face files

Not too long ago, someone posted some VISIO files for the meter faces for the R390A. Can whoever created those please email me? I have an older version of VISIO and I would like to take these files into the application, but my version tells me the files are not VISIO files (assumably because they were created with a new version). If these could be saved for an older version, perhaps I could still use them.

From: "Merle" <lal@cyberwc.net>
Subject: [R-390] Visio Meter Face files
Date: Fri, 22 Aug 2003 12:36:14 -0400

Hello Scott.. I think the fellow your referring to might be David Goncalves. He was going to reproduce some meter faces, the one I am after is for my R-392 I think we should be hearing from him soon. Hope this might help..

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Visio Meter Face files
Date: Fri, 22 Aug 2003 11:39:07 -0500

Yes, you are correct. I even have that email saved in my files -- duh! Sorry for the bandwith fellas.

Date: Sat, 23 Aug 2003 14:42:10 +0100
From: "David P. Goncalves" <dpg@coe.neu.edu>
Subject: [R-390] Visio Meter Face Files

Problem fixed :-). The files are still available here:
<http://www1.coe.neu.edu/~dpg/R390Face.vsd>

Some time ago, I asked if any list member had a pair of matching meters that they would be willing to loan for a weekend. Unfortunately, the deal I had going fell through, and I never did get a pair to work with. So, I ask again: Is there anybody on the list in the Boston area (beyond is OK too) that would be willing to loan me thier matching meters? I want to get a set of high-res images to work with, as I feel the quality of the dials in the files I have now are not 'the best'. Please, no photos of meters.

Date: Sun, 24 Aug 2003 12:18:22 PDT
From: "Gary Gitzen" <gfgitz55@orca.cetus.com>

Subject: [R-390] Radioactive meters

Hi R-390 fans (and a certain Barry, resident chemist on another list), David Goncalves wants to reproduce R-390 meter faces. I've offered to investigate taking decent pix of original meters. This would involve removing them from their case, and possibly removing the meter face from the meter body. These contain, I believe, radium based material on the meter face. I'm wondering if anyone on the R-390 list knows exactly what's involved in working with these meters. Any particular precautions to be used, other than rubber gloves and a good dust mask? Real Science preferred here, if possible, I seem to remember reference to a gentleman in Livermore CA who does meter repair. Can anyone provide contact info? Thanks in advance for any information.

From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Radioactive meters
To: r-390@mailman.qth.net

Maybe not so tough,.... With a light inside and a good quality piece of glass for the window, angled 45 degrees from horizontal, surgical gloves with long cuffs. Granted it will take some consideration in the making and practice in the operation. I shouldn't think it would need to be more than 16" X 16" and 24" long, maybe with another section of the same size with an "air lock" between to use for bringing in tools and parts while working. Take pictures through the glass? Seal it all up with RTV, hose clamps or Ty-wraps on the glove cuffs stretched over some PVC pipe sections. I almost think we've discussed this before, too.

Date: Sat, 22 Nov 2003 15:22:39 +0000
From: "David P. Goncalves" <dpg@coe.neu.edu>
Subject: [R-390] Scanning Meter Faces

Every so often I ask this, so here I am again. First, in cooperation with a list member I produced a Visio file that you can print out onto self-adhesive paper to redo your meters: <http://www1.coe.neu.edu/~dpg/R390Face.vsd>

The Visio plugin is free for download. They fit very nicely onto PRC-47 meters available from Fair Radio Sales. Also, is there anybody out there (the Boston area is best) that would be willing to lend me their meters for a weekend to scan? While the scans in the Visio file are OK, I'd like to get the 'final word' on this scanning issue, and generate a set of excellent quality scans for others to use in meter work (redrawing meter faces, or printing/sticking).

1. I understand the risks in handling an open meter, and have come up with a method to nearly eliminate exposure to particles. Yes, I know there is radium in there.
2. I'm not just some JF off the street asking for your meters. I am (for now, nearly graduated) president of the Northeastern University Wireless Club (W1KBN) and as such, you will receive a guarantee from myself, the senior E.E lab tech (doing the scanning work under his supervision) and the faculty

advisor that your meter will not be subjected to any unnecessary risks or adjustments.

3. And if something should happen to your meter, I offer to compensate by giving the donor my own converted meters AND all of my R-390.

4. Shipping to and fro (if not dropped of by hand) I pay for. I pack well.

I'll happily accept scans from owners (hey, less work from me!) but I ask that they be nice scans without lossy compression - TIFF files are OK, JPG are not. If you can get a scan of the removed dial plate face down onto the scanner, you'll have done it. Acceptable is scans of the unremoved dial plate, if you take two scans with the meter needle in two positions. Please don't send digital photos of the meter in the case, I have quite a few already. Thanks, and hope somebody out there is willing.

Date: Sat, 22 Nov 2003 09:15:02 -0800
From: Buzz <buzz@softcom.net>
Subject: Re: [R-390] Scanning Meter Faces

I have some meter faces at: <http://webs.lanset.com/buzz/meters/faces.html>

From: David Hallam <dhallam@RapidSys.com>
Date: Sun, 23 Nov 2003 10:27:06 -0500
Subject: [R-390] R-390 Meters

I know every one is looking for R-390 meters. I don't need a whole meter but just the metal cover. I have carefully repaired the broken case and a local glass shop cut a new glass for the meter. But the metal cover for my carrier level meter is damaged beyond repair. Does anyone out there have a left over cover they might part with?

From: "JimMiller" <jmiller1706@cfl.rr.com>
Date: Mon, 22 Mar 2004 23:27:13 -0600
Subject: [R-390] Sticky Carrier Meter

I have a practically new carrier meter that tends to stick around 60-90 on the scale. It was purchased NOS in original sealed envelope. Tapping it lets it move all the way. It is one of the kinds that has the glowing calibration marks. Is this a sign that some of the coating has flaked off and is jamming the meter movement? What are the suggestions?

Date: Fri, 30 Jul 2004 17:15:58 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Hello

<snip> The whole carrier meter calibration thing gets a bit involved. The radios probably need a full alignment if they have been in storage for a while. As part of the process you set the carrier meters up so they agree with each other. A signal

generator is pretty useful for this process. The IF gain is also set as part of this process and that also affects the radio quite a bit. There are differing opinions on the best setting of the IF gain.

One nice thing about having a pair of radios is that you can swap modules between them if you suspect a problem. This makes the whole maintenance process a whole lot easier. For example you might have a leaky capacitor on your agc line. That line runs all over the place. It's nice to be able to swap out the IF deck to isolate the general location of the problem before you tear into the RF deck.

I'm sure some of that doesn't make a lot of sense right now, but hopefully it will as you dig into the radios. Don't be afraid to work on these beasts. They were designed to be maintained and aligned by your average joe. They are tube based so they will require a bit more tender loving care than a solid state radio. That said, they are well worth the effort.

Date: Tue, 10 Aug 2004 08:39:22 -0400
From: "Larry and Jody Cogan" <woodrat@citynet.net>
Subject: [R-390] Line Level Meter

Yesterday was an unlucky day.....found a dead line level meter on a long inactive 390A. Hoping today will be a lucky one and some lister will have a meter they are willing to part with. I do expect that it wont be cheap. If anyone can help, please reply off list.

Date: Tue, 10 Aug 2004 18:21:58 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Line Level Meter

Obviously if the poor meter got in the way of a fast moving object that's a problem. If it is physically intact I would bet that it can be fixed. The R-390 meters are a bit harder to pop open than the plastic face meters you see in a lot of commercial gear, but the guts of the beast is the same. More or less you have the mechanical meter movement and some wires. In some cases you have a resistor or two in there. The meter movement is easy to check. If it wiggles when you rock the meter back and forth in your hand then the bearings and springs are ok. If it is pegged hard one way or the other you may have a problem with a spring. If it is sitting mid scale and not moving then it's come off of a bearing.

If the movement is mechanically ok then the problem often is a broken wire or a failed series resistor. Usually these problems are the most common and the easiest to fix. I suppose there are audio meters with diodes in them as well. Again that should be an easy fix.

The one you worry about is the meter armature winding burning up. If that happens then you have a bit of a problem. Other than stuff that has been really nuked (as in 10 amps does not go well through a 10 micro amp meter ... trust me on this one) the armature rarely is the point of failure.

If you do open up the meter you may be overcome by an impulse to eat some of the glow in the dark paint. Be sure to open the meter in the presence of another adult in case this happens to you. Multiple reported incidences of this behavior are the most likely driver in the military's long standing policy of removing meters from equipment destined for disposal. Again, you have been warned

Date: Tue, 10 Aug 2004 19:47:50 -0400
From: "JamesMiller" <jmiller1706@cfl.rr.com>
Subject: Re: [R-390] Line Level Meter

Have you checked to be sure it's not something besides the meter, such as the meter switch or a connector? A radio sitting unused for long periods can develop corrosion in switches and connectors. Just a thought...

Date: Wed, 11 Aug 2004 11:28:15 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Line Level Meter

In the case of the line level meter, there is a rectifier, too.

>The meter movement is easy to check. If it wiggles when you rock the meter
>back and forth in your hand then the bearings and springs are ok. If it is
>pegged hard one way or the other you may have a problem with a spring. If
>it is sitting mid scale and not moving then it's come off of a bearing.
>If the movement is mechanically ok then the problem often is a broken wire
>or a failed series resistor. ... I suppose there are audio meters with
>diodes in them as well. Again that should be an easy fix.

Exactly, there could be a failed rectifier. Replacement with non-selenium diodes will likely cause increased deflection with the correct ac voltage for 0 VU. An external resistor will cure this, unless you want to change any you find inside the meter.

Notes:

1) The R-390 line level meters are AC meters. They indicate 0 VU for line level output at the rear terminals of the radio.

2) The pictures of line level meters I have at hand do not show a zero on the dial markings.. only a "VU" at the place where 0 should be which is at the "100" of the 0-100 dial markings.

3) The meter movement is a DC mechanism. The meter case contains a rectifier (and presumably a resistor or two to set the correct calibration.) The meter has an impedance of 3900 ohms. (That is *not* the dc resistance of either the meter movement or the complete meter with rectifier.)

4) If your meter has luminescent markings,

DO NOT OPEN IT UP AND EAT THE INSIDES.

Date: Wed, 11 Aug 2004 13:14:38 -0400
From: Sheldon Daitch <sdaitch@ibb.gov>
Subject: Re: [R-390] Line Level Meter

I can't speak for the R-390 meters, but most honest VU meters use a bridge rectifier, not a single diode, for rectification. In the Simpson and Weston meters, at least the larger ones, like on audio consoles, the diodes are similar to copper oxide disks, in a four pack stack, and the diode case can be opened, allowing the diodes to be replaced individually. What normally happens is that the meter will read 1-2 dB below full scale with the proper input. We were replacing meters like this on our console at Greenville VOA, and ran out of meters. I found some old ones, with the same problem, too low a meter reading, and pulled one apart for investigation. I think I wound up fixing 3-4 meters out of about 6-8 "dead" ones. The smaller R-390 meters are much too small for the larger diode bridge, and since I have never worked on one of these meters, I really can't talk about their specifics.

Date: Mon, 23 Aug 2004 13:16:20 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] R390A Carrier Level Meter Question

Yes, but there's more. Not just any 1 ma full scale meter of the right size will work. The original meters had an internal resistance of 17 ohms or some such. Hard to find. Not impossible to have made but they's cost some \$100 each if we ordered over a hundred. There have been a number of articles and web pages that describe how to use other meters instead of the original one.

Date: Mon, 23 Aug 2004 13:18:45 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] R390A Carrier Level Meter Question

Probably would be good to include the specs. on the VU meter as well... I assume it is unique in some way as well..

Date: Mon, 23 Aug 2004 11:27:45 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] R390A Carrier Level Meter Question

Wondering what will happen if you put in any old 1mA meter? The R-390, R-391, and R-390A use the meter as one leg of a bridge circuit, and the meter was wound with unusually heavy wire to get the exact resistance required to give the correct calibrated response. Most 1mA meters have coil resistance higher than 17 ohms. If you install such a meter, the radio won't be harmed, but the meter will not go upscale as far as it should for a given carrier level.

There is info around which explains how to modify the radio to use a given meter, and other info on building an amplifier to make a meter compatible with an unmodified radio. I don't know if the following is mentioned anywhere. It probably

is, but it doesn't take much space to explain, and if you can find an appropriate meter it's the "smallest" mod possible.

You are not restricted to a 1mA meter per se. You can use a more sensitive meter along with a shunt to give a 1mA full-scale response. This does not escape the basic problem of coil resistance, but it does widen your options a bit.

For example, if you had a 50uA meter with 340 ohms coil resistance, you could shunt it with 17.9 ohms. The problem is, 340 ohm 50uA meters are just as rare as 17 ohm 1mA meters. Still, you never know what will pop up in the junk box.

By the way, there's nothing sacred about the exact 17 ohm value, that's just what they found would give about the right cal most of the time. If you really care about this and have a signal generator where you can trust the output level, you can calibrate the meter to match your particular radio by tweaking its resistance slightly.

On the other hand, this goes against the idea of interchangeable parts, which was a fundamental tenet of the radio's design.

Date: Mon, 23 Aug 2004 18:56:57 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] R390A Carrier Level Meter Question

One of the amazing things about an R-390 is just how accurate the carrier meters are. Every one I have checked has stayed pretty darn close over the whole range above 20 db.

They have been pretty good at 10 db. When you take a look at what they had to do to make that happen there's a lot that went into it.

All that said there is another way to go. The good old back panel connector has the AGC voltage on it. No big surprise that the AGC voltage also follows the carrier level. In a number of situations the AGC voltage was used instead of the carrier level for accurate signal monitoring. If you are going to rig an external setup there should be a way to do a LCD display that would show signal level to a tenth of a db over a 100 db range. You'd be the only one in town with one of those

By using the AGC voltage you would also get around the normal problems with the carrier meter zero pot. That alone would be worth the effort.

Date: Mon, 23 Aug 2004 19:39:35 EDT
From: DCrespy@aol.com
Subject: Re: [R-390] R390A Carrier Level Meter Question

I assumed you were asking to decide on a substitute? If so: the problem is not the full scale current, it is the internal resistance of the meter. Most 1ma movements are 100 ohms. The R-390A needs (if I remember right) 18 ohms. I have successfully used up to 38 ohm movements with completely comparable results. 100 ohm movements just do not work. If you are thinking of shunting a meter, the

problem is the same. Most 100 microamp meters are 1000 ohms, so shunted, you still wind up with a 100 ohm / 1 ma meter! The 38 ohm meters I have used (International brand) had a series internal resistor, that when removed dropped the meter resistance.

Date: Mon, 23 Aug 2004 21:08:59 -0500
From: "Dennis Pharr" <dpharr53@swbell.net>
Subject: RE: [R-390] R390A Carrier Level Meter Question

Thanks Harry (and all the other respondents) for the advice. Actually, I was aware of the meter resistance issue. I was never intending to try to directly substitute another 1 ma. meter movement directly into the existing R390A bridge circuitry. I've found a couple of matching 5 ma. meter movements in my junkbox that I've decided to use. I'm planning to use an (dare I say this) external opamp DC amplifier along the lines of the Jan Skirrow article "Adapting Surplus Meters for the R-390A" (link below):

<http://skirrow.org/Boatanchors/TechTalk2.pdf>

Calibrating the Line Level VU meter will be no problem. Trying to calibrate the Carrier Level meter is another issue entirely - I'm not even going to try. The plan is to install the opamp and meters, tune to a locally strong broadcast band station and set the pointer on the Carrier Level meter at about 75% full scale and call it done.

Thanks again to everyone for all the advice. This email list is the best resource I've ever run across on any subject in amateur radio or SWL. The wealth of knowledge here is simply amazing.

Date: Mon, 23 Aug 2004 22:53:43 EDT
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] R390A Carrier Level Meter Question

Very good points Harry! I had investigated using other meters in the past. I had determined that if you picked up a nice assortment of 100 and 50 microamp meters (usually at hamfests - 1 3/4" square size) you would hit on one that had the right amount of internal resistance that could be shunted and end up with a 0-1ma movement with a resistance in the 18-40 ohm ballpark.

From then on you would know which scale and type of microammeter to be on the lookout for. Lafayette Radio used to sell a line of Argonne panel meters that would fit the R-390A front panel. (1 3/4" square size)

I have one R-390A with a Lafayette/Argonne VU meter that fits just right and looks very nice and appears to have the right sensitivity. That would be one meter to be on the lookout for to substitute as a line-level meter.

Date: Mon, 23 Aug 2004 20:46:16 -0700
From: "mparkinson1" <mparkinson1@socal.rr.com>
Subject: [R-390] R-390a meters

How can you really test what the resistance is on the sub 1Ma meter? I have several of them I did put it into the R-390a receiver to test it and it seems to work very well. I compared it to the original meter watch both working at the same time and frequency and didn't see any difference. But would like to know how to test the internal resistances of the movement. thanks Matt.

Date: Tue, 24 Aug 2004 05:17:50 -0400
From: "Larry and Jody Cogan" <woodrat@citynet.net>
Subject: [R-390] Dead Line Level Meter

A couple of weeks ago I asked if anyone was able to "unleash" a line meter to replace a dead one I had. I wanted to thank all who responded, with advice on how to tackle possible repairs. It was the meter...it was "open". One kind lister is supplying me with a replacement. I will put the old one away, to be opened when the next one goes south or till my poor, long suffering wife has to peddle all my "junk" in my estate sale!

Date: Tue, 24 Aug 2004 11:07:48 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] R-390a meters

>How can you really test what the resistance is on the sub 1Ma meter? ...
>would like to know how to test the internal resistances of the movement.

There was a long thread on this some time ago. I now can't find any of the posts, but here is a summary of the situation:

1) There is a technique in at least some ARRL Handbooks to measure the internal resistance of a DC meter. Part of the discussion was that the method described would lead to some errors. Those errors may be small with a higher voltage battery (such as 6 volts instead of the single cell they suggest.) Be *very* careful with clip leads and such. Any normal battery will destroy a 1 mA or 50uA meter in less time than it takes you to say "OH DARN!"

2) Short method: Get a voltage source and a resistor estimated to get the meter to full scale. Make up the resistor of mostly fixed and partly variable (this reduces the chance of a disaster.) Set the current to full scale and then connect a second variable resistor *across* the meter and adjust till it reads *half* scale. Remove the parallel resistor and measure it with an ohmmeter to get the internal resistance of the meter.

3) Refined method: Do as above but put a current meter in series with the circuit (a DMM is good here). Alternately adjust both variables for the original full scale circuit current and half scale reading. This will eliminate errors due to changed total current. The difference may be negligible with sensitive meters. If your meter has a full scale current of 25 mA or so, it will matter a lot.

4) If you know or can measure the full scale current of the meter, and you can

measure very small voltages with moderate accuracy (e.g. 50 millivolts): Set up the series circuit with variable resistor and measure the voltage across the meter. Apply Ohm's law to figure the internal resistance.

Date: Tue, 24 Aug 2004 15:04:12 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] R-390a meters

You would do the 1/2 scale method. That is you put a high-value pot in series with the meter and a low-value pot, those in parallel. Then you put a small DC voltage acrossed that set-up and set the high-value pot to the point where the meter reads full scale, then you set the low-value pot to where the meter is at 1/2 scale. The resistance of the low-value pot is now equal to the DC resistance of the meter.

Date: Sun, 29 Aug 2004 22:53:15 EDT
From: N4BUQ@aol.com
Subject: [R-390] Using Surplus Meters in an R390A

I downloaded Jan's article about using surplus meters. Looking at the schematic, it appears that inserting the OpAmp where the meter used to be will result in a minimun of 9.4K ohms where (according to what I remember posted on this list) the original meter's DC resistance is somewhere around 30 ohms. Can someone comment on how/if this affects the performance in this part of the radio? The text of the article indicate it is necessary to reset the carrier meter adjust control for the proper readings. I assume that the difference of the resistance will cause this setting to be somewhat different than with a meter with 30 ohms resistance. I haven't looked at the entire circuit yet and perhaps resetting the carrier meter adjust control to compensate the difference in resistance causes the circuit to become "normal" again, but not sure. I have some replacement meters I am interested in using, but their internal resistance is around 600 to 800 ohms so I was looking for a way to use them. It appears Jan's method is easy enough, but I was wondering what the effects are when using it.

Date: Mon, 30 Aug 2004 15:00:36 -0400
From: N4BUQ@aol.com
Subject: RE: [R-390] Using Surplus Meters in an R390A

I agree with this. I was trying to come up with a solution using the existing (hi-ohm) meters with a resistance network. As I was drawing it up and attempting to come up with shunt resistor values, etc., it occurred to me that I would need the voltage across the original meter. As I started looking at this, it became crystal clear that a network of resistors would not work. The voltage across the meter could not be increased by the network (hope that makes sense). Maybe I'll try your carrier level mod on my next radio. I replace the one in my current radio with the 10-turn wirewound. Works fine.

Date: Mon, 30 Aug 2004 15:00:18 -0500
From: "Laird Tom N" <LairdThomasN@JohnDeere.com>
Subject: [R-390] RE: Using Surplus Meters

The following is from my archives dated 1997. I'm not sure if any meter sets are still available or even the status of the author! You still may have to do the op-amp trick.

I have located a source for some used meters that are very similar in appearance to the original meters used in the R-390a's. I took the meter faces from my original R-390a meters and scanned them into a drawing program so that I am able to print them out on adhesive backed polyester sheets. I then disassembled the new (used) meters and applied the labels to the back of the meter cards, reassembled, and voila, instant R-390A meters! Of course there is the matter of converting the line level meter over to AC operation, but this is easily done with a bridge rectifier. The rating of the new meters are 30 ohms at 1 mA for the carrier level meter and 100 ohms at 1 mA for the line level. I was skeptical at first that I would have much luck with the line level meters due to the great difference between the specs of the originals and the replacements. I have found, however, that functionally the only difference is that when the Line Meter attenuation switch is set one position higher the behavior of the meter is almost identical to the original. A couple of my friends saw my R-725 with its new meters and wondered where in the heck I had managed to come up with a set of original meters for the thing. After I told them the secret I gave them the parts and a few instructions and now they too have working meters where there used to be holes. They liked the new meters so much that they talked me into getting busy and making up a set of illustrated instructions on my computer. My question for you BA folks is this; How many of you might be interested in a R-390a meter kit, with all of the parts and instructions for the princely sum of \$25, shipped? This is about what I figure it would take in order to pay for the parts and make it worthwhile to run back and forth to the post office. The kit would include all mounting hardware, 2 used (checked) meters, meter appliques in both white on black and black on white, diodes, and an instruction sheet.

Date: Mon, 30 Aug 2004 15:27:39 -0500
From: "Dennis Pharr" <dpharr53@swbell.net>
Subject: RE: [R-390] Using Surplus Meters in an R390A

I had the same thought when I started building my version of the op-amp circuit. I believe that by not having a resistance that simulates the meter impedance it may upset the way the bridge circuit works. Although it may not make a big difference, I installed an 18 ohm resistor across the input to my version of the op-amp circuit. The op-amp then essentially just amplifies the dc voltage drop across this resistor. With an 18 ohm resistor shunting the input, the voltage seen by the op-amp is only about 18mv (assuming a full scale 1ma reading), so the voltages you are dealing with are quite small. Actually, the way I understand op-amps, the combined resistance of the two 4.7K input resistors wouldn't make any difference anyway, since no current flows into these inputs. Without the 18 ohm resistor, the op-amp circuit would only amplify the voltage difference seen between the arms of the bridge circuit. Also, the 10K ten-turn pot used on the output of the Skirrow circuit is much too large for effective use. I used a 1K ten-turn pot. This made it much easier to set the sensitivity of the meter I used (5ma meter movement).

Date: Tue, 31 Aug 2004 07:12:57 -0500

From: Tom Norris <r390a@bellsouth.net>
Subject: Re: [R-390] RE: Using Surplus Meters

Y'know I still have one of Tom's kits. I ordered one way back when in case I ran across a receiver with no meters. So far all I've gotten have had meters, but those with them seem few and far between, so, no it isn't for sale. :-P

Date: Tue, 31 Aug 2004 11:42:49 -0400
From: N4BUQ@aol.com
Subject: Re: [R-390] RE: Using Surplus Meters

Could you perhaps tell us what is in the kit? I have some surplus meters that I'd like to use; however they have an internal resistances of 600 and 800 ohms. Mr. Bowes didn't mention the internal resistance of his meters or how he compensated for them. I realize the VU meter isn't as tricky, but the carrier level meter probably needs some attention to matching resistances, etc.

Date: Tue, 31 Aug 2004 12:21:00 -0500
From: "Laird Tom N" <LairdThomasN@JohnDeere.com>
Subject: [R-390] RE: Surplus Meters

I don't know the meter details of Tom's KK8M KIT'S. I did a search on his name and came up with Thomas Bowes, phone: 586-677-9498; email: bowes@klondyke.net
I did not try to call him or email him, but you might give it a try.

Date: Tue, 31 Aug 2004 20:29:20 -0400
From: "Michael Murphy" <mjmurphy45@comcast.net>
Subject: Re: [R-390] R390A Carrier Level Meter Question

Here is a link for the whole list that shows the variable persistence meter modifications. <http://home.comcast.net/~gerboid/R390Magic1.jpg>

Date: Wed, 1 Sep 2004 21:37:14 EDT
From: DCrespy@aol.com
Subject: Re: [R-390] RE: Using Surplus Meters

I got to know Tom Bowes a 5 or 6 years ago, when I bought one of the kits in discussion right now. Until about 2 years ago (?), I ran into him regularly at swaps in the Detroit area. I always enjoyed talking with him. Really decent guy! Anyway, the kits included two International brand 1 mA meters. They had 100 ohm movements, as delivered. Somehow, Tom had found that there was an internal series resistor in these particular movements. Jumpering (shorting) the resistor brought the series resistance of the meter down to about 38 ohms (on the one I got from him). That was close enough to the 18 ohm spec that the meter actually worked in the application. I had occasion later to compare the meter movement to a couple of correct original meters. On the same radio, same signal source, could see no difference in the meter readings.

Tom supplied a some standoffs and diodes for the line level conversion, all of the hardware, a special socket to disassemble the meter face, and sets of both white face and black face meter scale overlay stickers. A nice kit, however I believe he has been out of them for years now. I still have his instructions and will scan and send them, if anyone is interested. (It may be next week before I can respond however.)

Two caveats, 1) If you find a kit, these are the glow in the dark movements, so open the cases at your own risk. And 2) If you are looking to convert other International brand 1 mA meters, I have opened many of them and have never found another with this internal construction (with series resistor to short). Tom found an interesting stash!

Date: Fri, 24 Sep 2004 07:10:23 -0500
From: "Dallas Lankford" <dallas@bayou.com>
Subject: [R-390] Carrier Meter Linearization

TM-11-856A, among others, shows (in Fig. 41) a linear (wrt dB) carrier meter response for the R-390A. As we all know, of course, this is not the case. Carrier meter readings are always 20% to 30% low (20 or 30 dB less than 100 dB when a precision signal generator is used to examine the accuracy of a carrier meter in an R-390A through its 100 dB range). The reasons for the inaccurate carrier meter readings are incorrect values for R524, the R523 + R537 assembly, and R548. After removing R524 and R548 and bringing insulated wires out of the IF deck so that I could vary those values, I determined that (1) R537 (22 ohms nominal) should be removed entirely (to provide more range for meter zero adjustment), (2) R524 (680 ohms nominal) should be replaced by 649 ohms 1% (since R524 is usually higher in value than it should be, you can usually obtain 649 ohms by adding an appropriate resistor in parallel), and (3) R548 (27 ohms nominal) should be replaced by 62 ohm 1%. R523 should probably be replaced by a 10 turn 2 watt high quality 100 ohm wire wound variable resistor to make zero adjustment easier and to improve long term zero set stability (though "zero" will still drift around a bit).

Date: Mon, 14 Feb 2005 08:29:43 -0500
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: [R-390] Sticky Meter Movement

In the past there have been threads about what to do with sticky meter movements. I didn't file any of the information. Over the weekend I picked up a very nice HP 606B signal generator, but it has a sticky output meter. If I take to meter off and open it up, the movement seems to be free and move without any problems. When I reassemble it and put it back on the panel, it is sticky. The meter is not damaged in any manner that I can see. Any suggestions about how to proceed?

Date: Mon, 14 Feb 2005 08:48:16 -0500
From: "Dulaff, Paul" <PDulaff@dpconline.com>
Subject: RE: [R-390] Sticky Meter Movement

Sometimes, static electricity can build up on the front of the meter face and cause a

meter to appear sticky. This behavior happens with plastic meter enclosures. If the movement is free when the meter is out of the enclosure, this may be the case. Try washing the front of the meter face with water and detergent.

Date: Mon, 14 Feb 2005 09:46:00 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Sticky Meter Movement

As Paul wrote, static is the first thing to check out. If you move your finger over the meter glass and the pointer "tries" to follow, then it's static. Gear that is shipped with plastic or bubble wrap often arrives with a bad case of static-y meters -- or may become that way as a result of one's initial cleanup efforts. Put a few drops of dishwashing liquid or soap in some water and wash down as Paul advised. You don't have to drown the thing. Don't buff it dry or you'll recharge the thing.

Another possibility -- something binding against the movement -- particularly the spring, or applying torque to the frame when tightened into the housing. Try loosening the housing screws a bit. See if there isn't some binding occurring where the meter's adjustment tang links up to the screw in the meter case, or the spring might be rubbing on the inside front surface of the housing. Also check that the bottom part of the pointer (below the pivot point) isn't touching something in the housing. If nothing is bent or out of whack, and there is binding against the housing, then you may need to shim it with something when reassembling, so as to back the meter movement away from the front of the housing by a hair.

While I have a 606, I don't know offhand what the meter design is, but it's probably one with conventional needle bearings -- possibly jeweled like watch bearings. When the needle tips wear or the frame expands a bit or whatever, there could be too much play. The meter will work freely in one position, but bind in another. The fix is to adjust the bearings -- and many of the meters have adjustable bearings -- usually set with a blob of glue or glyptol. Avoid touching the pointer itself. If you can tilt the mechanism to force the jamming or sticking to occur, that's what's going on. If this is the case, the bearing(s) need to be tightened up just a hair. Over-do it however and you can cause damage. I've done this myself successfully, but then it was obvious that the pointer and armature were wobbly fore and aft -- after looking carefully at close range -- and the movement was sticking in or out of the housing.

Also check the spring as you move the needle. (Move the pointer by gentle blowing on it or rotating the frame -- avoid touching it.) Make sure the spring is coiling and uncoiling smoothly and not twisting around or popping in such a way that it would rub against the inside of the housing when assembled.

Hopefully, it's just static. If so, the meter will usually work as current is applied, and the readings past full scale may be accurate, but it will typically fail to zero.

Date: Mon, 14 Feb 2005 12:01:49 -0500
From: N4BUQ@aol.com
Subject: Re: [R-390] Gear Diagram Needed

Found the diagram in the Y2K manual, but also loaded your hi-res diagram too. I should be set now. Thanks! Barry(III) - N4BUQ

>.....><http://www.jamminpower.com/PDF/TM11-856A.wide.pdf>

Date: Mon, 14 Feb 2005 12:50:27 -0600
From: "Steve Goode" <goode@tribeam.com>
Subject: Re: [R-390] '390 meter face facsimiles?

This may be what you remember: <http://webs.lanset.com/buzz/meters/faces.html>

Date: Sun, 13 Mar 2005 19:07:29 -0500
From: "John KA1XC" <tetrode@comcast.net>
Subject: [R-390] Painting International Meters - need some advice

Has anyone ever painted International meters? Most 390 meters I've seen have a metal faceplate that easily detaches and is no problem to refinish. Now I've got a pair of International meters I'd like to do but they are built differently. They have a rather solid (milled?) faceplate that can be removed but the glass stays attached. First you have to pry out the rear rubber gasket that's between the round meter case and the faceplate. Then there are 4 reverse threaded hollow-center fasteners to remove. Now the faceplate + glass is free from the meter case and the meter "innards" are exposed, which is usually something I prefer to avoid. But the real problem is that the glass is still attached to the faceplate with a gasket, and I don't know if it's permanently glued in or not. And with the glass still attached, the faceplate is really not in any better state to refinish than if the whole meter was simply left intact and the glass masked off. What to do?? Here is a pic of the meter when I had it apart a few weeks ago to take a peek, the glass really is in the faceplate but it's not visible in the pic:

<http://img198.exs.cx/my.php?loc=img198&image=dscn0038c5gy.jpg>

From: "Barry" <N4BUQ@aol.com>
Subject: Re: [R-390] Painting International Meters - need some advice

I have a meter just like the one you show that I'd like to have painted (powder coated) as well. So far, I haven't gotten up the courage to take the cover off and expose the innards. Quite frankly, just looking at the picture of your exposed meter is sort of scary :~) I'll be interested in knowing what you find out concerning removing the glass from the front case.

Date: Sun, 13 Mar 2005 21:52:41 EST
From: Flowertime01@wmconnect.com
Subject: [R-390] Meter glass stuck to meter face.

Its the old meter glass is stuck to the meter face trick. Sorry you both have old rubbers. This is quite common and not just R390 related. Its skill and craft time. Get out the exacto knives and do some surgery. I would recommend some solvents, however you have exposed meters and solvent in the jewels could be worse than the cure. Start with two knives or a couple razor blades. Do not respond if blood

becomes involved. (be careful) No one on the R390 net will want to hear about it. In easy with a blade between the glass and the rubber gasket. Do not pry at large angles. Try not to mark up the meter face with a blade point. You will likely need to work around the whole meter face. What do you fellows plan to do to create new meter face art? There are some real nice new art coming off the printers. However the problem is getting that ink onto a surface with stick stuff that will really stay on a meter for the next unpteen years.

Date: Thu, 24 Mar 2005 22:13:41 -0600
From: "Barry" <N4BUQ@aol.com>
Subject: [R-390] Question about Carrier Level Meter

I have some 100uA meters that I'd like to use as replacements for the meters in my R390A. They are supposed to have an internal resistance of 100 ohms. Supposedly, by shunting with an 11 ohm resistor and then placing an 8 ohm resistor in series, this will make them effectively 1mA meters with approximately the same internal resistance as the original meters.

I experimented a bit tonight with this and I didn't get the results I thought I would. I shunted one of them with 11 ohms and placed it in parallel with the existing meter. I expected both meters to read approximately 1/2 of what they normally would in the circuit. Instead, the shunted meter barely moved and the original meter hardly noticed the new meter in the circuit. I removed the shunt and the new meter read a bit more, but not nearly as high as the original meter that it was in parallel with.

I then placed an original meter in parallel with the existing meter and I got the action I expected. For example, a 60dB signal would show as about 30dB when they were connected in parallel. Is this happening due to the fact that the internal resistance of the new meter is so much higher than the original meter and the current is simply taking the path of least resistance? If I remove the original meter from the circuit, can I expect the new meter to perform better or will it be low reading no matter what? If I have to, I'll build Jan's circuit and tune them up that way, but I was hoping to simply use a resistance network and use them as is. Maybe not?
Thanks,

Date: Fri, 25 Mar 2005 05:31:00 EST
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] Question about Carrier Level Meter

Unless both meters have EXACTLY the same internal resistance and full-scale readings they will not read equal when placed in parallel. Have you tried placing the meters in series when testing them? If you place the meters in series it will assure equal current in both meters. Do you have a way to measure exactly the internal resistance of the 100uA meters? It sounds like they may not have an internal resistance of 100 ohms from your results. I would try a low-value variable resistor across the 100 uA meter to see if you can 'dial in' an equal full-scale reading. It won't work to place an additional resistor in series with the 100 uA meter AFTER it has been set to read 1mA full scale, that will throw the full-scale reading off again. You would have to set the 100 uA meter for a reading somewhat less

than 1mA full scale and then add the series resistor if you absolutely had to have the same series resistance as the original meter. Again I would play with a variable resistor across the 100 uA meter to see what results you can get.

Date: Fri, 25 Mar 2005 09:02:06 -0500

From: Bob Camp <ham@cq.nu>

Subject: Re: [R-390] Question about Carrier Level Meter

Here's how to at least begin the process of figuring out what's going on:

- 1) Grab a D cell and a 20 K ten turn pot (or something similar)
- 2) Set the pot to max resistance and hook it up in series with the new meter and no shunt
- 3) Adjust the pot so you have a full scale reading on the meter
- 4) attach the shunt and see if the meter goes to around 1/10th scale

You won't get exactly 1/10th scale because of the meter resistance but you should get close. If you get something lots lower then the new meter is well above 100 ohms resistance. If the reading is significantly higher then the meter is well below 100 ohms resistance (my bet is on low). If you now rig the new meter and shunt in series with a 1 ma reading VOM you can adjust the shunt to give you 1 ma full scale. If that works out to a 4 ohm shunt, then that 's what you use. There is only one value of shunt that will do the trick. I keep a couple spools of resistance wire around for this kind of thing. The next part is magic. The shunt will always be 1/9th of the meter's resistance. If you know the shunt you know the resistance of the meter plus shunt. The meter will do odd things in parallel with an existing meter. Putting a second meter in drops the impedances and messes up the circuit. Simply measuring the voltage across the meter does not mess up the circuit. When you put the new meter with no shunt across the existing meter you are using the new meter as a high impedance volt meter. Strange to be talking about a 100 ohm current meter as a high impedance voltmeter, but that's what it is compared to a 10 ohm system.

Date: Fri, 25 Mar 2005 08:22:16 -0600

From: "Barry" <n4buq@aol.com>

Subject: Re: [R-390] Question about Carrier Level Meter

I did a similar experiment as you describe below when I first got these meters, but it was quite some time ago. I placed pots bot in series with and shunting the meter as well as putting my DVM (in the CURRENT mode) in series with the circuit. I don't remember the value of the shunt, but I think it was pretty close to what would be correct for the stated 100 ohm value of the meter. I'm going to do this with the "good" 1 ma meter in series and see what values I get when the "new" meter has the 11 ohm shunt. I'm guessing they will read pretty close. If they do, then I'm going to try disconnecting the existing meter in the working radio and only using the new, shunted one. I'll try to report my findings. If this works, I plan to make replacement meter faces for these as I plan to construct the Line Level meter from one of these

as well. Yes, I know the Line Level meter will need other modifications, but if I can get them both to work, they will match nicely.

Date: Sat, 26 Mar 2005 16:08:48 -0600
From: "Barry" <N4BUQ@aol.com>
Subject: [R-390] Carrier Level Meter findings

Last night, I did some more experimenting. It turns out the internal resistance of these meters is nowhere near 100 ohms. It took 140 ohms shunt resistance for these to read 1ma. By my calculations, this would make the internal resistance about 1260 ohms. In any case, the meter will read 1ma full scale now. I disconnected the meter in my working R390A and jumpered this one in place. The results were somewhat dissappointing. It works, but where the original meter will show a 60 reading, this meter will only show about 20. I'm sure it has something to do with the fact that the internal resistance is so high, but I don't know why that affects things like it does. I can even remove the shunt resistor an the meter still doesn't give much more reading. Looks like I'll either be building Jan's OpAmp circuit or finding some originals.

Date: Sat, 26 Mar 2005 23:27:07 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Carrier Level Meter findings

The problem with the "high impedance" meters is that the drive circuit for the carrier meter is a bit odd for a tube circuit. We tend to think of tubes as being high impedance devices. In this case the meter forms part of a low impedance cathode driven bridge circuit. The impedance of he meter actually makes up part of the cathode impedance on the driver tube. I'm sure they had their reasons for doing it this way. With the right meter in the circuit the carrier meter is amazingly linear.

Date: Thu, 26 May 2005 11:28:35 -0700
From: "Dan Merz" <djmerz@3-cities.com>
Subject: [R-390] Meter trivia

Hi, while listening and staring at the front of the 390a, I noticed that the two meters on the front panel have somewhat different shape/size. The first noticeable difference was that the line level meter window extended further down and revealed the pivot point of the meter whereas the carrier level meter on the right had a smaller window. I looked over at the 390 and noted that both meters on it were similar in shape to the 390a carrier level meter with the smaller window. The scales, etc seem to indicate these all are original meters. The 390 meters are different in one other aspect. They seem to have stamped metal housing with a sloped front transition immediately below the window whereas the 390a meters are blockier with more of a corner below the window. Some measurements indicated that the 390a line level meter with the larger window was 1.8 inches outside, which was the same outside size as the two 390 meters. The 390a carrier level meter was larger, slightly under 1.9 inches. Is this variation in meters typical of variations over the production life of the 390a, and have others seen this variation on their radios? Dan.

Date: Thu, 26 May 2005 13:13:31 -0700 (MST)
From: Richard Loken <richardlo@admin.athabasca.ca>
Subject: Re: [R-390] Meter trivia

Dan, as you observed, there were a number of variations in the meters that were used and making any assumptions on what was originally installed would be darn near impossible. Were the meters identical on the individual radios when they were manufactured? Maybe, maybe not. I doubt that the builder gave a darn whether the meters matched or not and if the meters were removed or replaced for any reason in the maintenance cycle then you can bet the farm that the technician didn't attempt to match them upon reinstallation. I don't think you can tell the difference between an R390 and an R390A meter since they have identical specifications. My R390 has two genuine mismatched meters of very uncertain parentage.

Date: Wed, 1 Jun 2005 18:08:12 -0400
From: "Patrick" <brookbank@triad.rr.com>
Subject: [R-390] R-390 (NON A)

<snip> Have a r-390 that have just finished working on it, replaced defective PTO, Crystal calibrator, checked all tubes and replaced some weak ones, then aligned it. It work great, But the carrier lever meter works backwards, the stronger the signal, the less the indication on the meter. Have replaced the meter and there is no change. Can someone put me on the right track for this problem? Thanks in advance for any and all suggestions,

Date: Wed, 1 Jun 2005 23:41:08 -0700
From: "Dan Merz" <djmerz@3-cities.com>
Subject: RE: [R-390] R-390 (NON A)

Pat, the thing that comes to mind is that you have the leads to the meter reversed. I looked at my meter and this would be easy to do. I assume if you zero the meter at zero then when a signal appears it goes downscale and off the scale, and hence you have to zero it toward the high end of the scale to get signal response the way you described. My leads are color coded but I don't know if the color code is universal to all 390's. But you could trace the leads with an ohmmeter back to the 6th IF tube/AGC tube to see which is which. The minus side should go to the AGC tube, the plus side to the 6th IF tube. Disconnect the two meter leads and pull the two tubes and measure from the cathode pin of each tube to the two leads to see which is which (power off on the set !!) Or just reverse the leads and see if it works ok then. Email me if you need more info on which tubes I'm talking about. Dan.

Date: Thu, 2 Jun 2005 11:03:21 -0400
From: "Patrick" <brookbank@triad.rr.com>
Subject: Re: [R-390] R-390 (NON A)

Dan, I did reverse the leads and the meter pegs on the 0 side and never moves from there. So, at least for now I think the polarity is OK. The strange part is that since I have two R-390, when I tune them both to the same station, both meters

settle at about the same DB level, both using very similar antennas. So it just does not bother me to much from a operational point of view, but it does from a purist perspective. If you have any other ideas, please let me know. I have the alignment procedures here at home, but do not have the wiring diagrams to try to make sense of this problem.

Date: Thu, 02 Jun 2005 11:05:30 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] R-390 (NON A)

I wonder if the meter is connected backwards and the zero set point is mis-adjusted.

Date: Thu, 2 Jun 2005 11:32:12 -0400
From: "Patrick" <brookbank@triad.rr.com>
Subject: Re: [R-390] R-390 (NON A)

Dan, I am eating crow, the leads were reversed and after going thru the carrier level adjustment found out that the pot was defective, have replaced it and all is OK now..... Thanks and sorry for the noise.

Date: Thu, 2 Jun 2005 08:46:50 -0700
From: "Dan Merz" <djmerz@3-cities.com>
Subject: RE: [R-390] R-390 (NON A)

Pat, I'm unsure from your comment what you are observing and with which polarity. It sounds like you reversed (or previously reversed) the polarity of the meter and now (or before) strong signals make the meter needle go upscale as it should. But you say the meter pegs at the zero side and never moves from there. Did you try zeroing the meter with the pot on the IF chassis at this time? If the polarity is indeed correct and the meter is pegging to the left near 0 then you need to adjust the zero pot on the IF chassis to bring the needle to zero with no signal. It may be so far out of adjustment toward the zero side that no signal can bring it back up scale. Once the meter is zero'd correctly and the polarity is correct, a signal should drive the needle to the right. I take it that your other 390 operates normally as far as signals driving the meter upscale and even though the 390 in question drives the needle in a backwards direction, the db points coincide. This is pure chance. If you have the meter polarity reversed and zero the meter with no signal, then a signal will drive the meter offscale to the left. If you reverse the meter connections under these conditions, the meter should stay zero'd (or approximately so) and now the signal will drive the needle upscale. My conclusion is: no matter how you have the meter connected, zero the meter with the pot on the IF chassis. After zeroing, the needle should go upscale with a signal. If it doesn't, reverse the meter connections. Now the meter should still be approximately zero'd and the needle should go the right direction upscale with a signal. You may have to re-zero the meter a bit. Dan.

Date: Thu, 02 Jun 2005 15:21:31 -0400
From: JMILLER1706@cfl.rr.com
Subject: Re: [R-390] R-390 (NON A)

Could this be an AGC problem? I seem to recall on my 390a that when I turned AGC off (MAN), is the radio saturated with strong signals the meter would tend to either stop moving upward or actually drop. Obvious question is: Do you have AGC enabled?

Date: Wed, 08 Jun 2005 17:22:42 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] Sources for meter movements?

I know Surplus Sales of Nebraska and Fair Radio have the stylistically correct meter movements for R-390A's, but are there other cheaper sources of meters that maybe don't have the right dial calibration or even the right coloring but do fit in the meter holes? I don't mind making a new dial scale and/or putting a small network in line with the meter to give VU readout. Even better would be a meter movement with a pilot light (or a clear back to allow a pilot light). Not nearly as correct as the radium dials but would be a lot more useful to me at night. Tim.

Date: Wed, 8 Jun 2005 16:28:56 -0500
From: "Barry" <n4buq@aol.com>
Subject: Re: [R-390] Sources for meter movements?

<http://www.leedselect.com/parts-meters.html>

Look for the second entry: DeJur 0-100 microamp I have a couple of these that I have had the trim powder-coated black. I still need to make faces and appropriate circuitry, but they are an inexpensive "fit" for the R390A.

Date: Wed, 8 Jun 2005 16:35:29 -0500
From: "Barry" <n4buq@aol.com>
Subject: Re: [R-390] Sources for meter movements?

Hmmm. Looking at the selection, the "Ideal VU Meter" as well as the "Simpson 1 ma fs 100 ohm" meters might be candidates as well. They don't state the size of them, but the Simpson looks a lot like the ones I've seen on R390A's. You'd need the faceplate cover, though, and I doubt they have those.

Date: Wed, 08 Jun 2005 17:41:10 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] Re: Panel meters

Cool. Those ought to be a good start! As long as we're discussing meters, my R-390A has a VU meter with the markings "59.1034" in the lower right of the face and a Carrier Level meter with the markings "ABM INST MOD.135-299" in the lower left and "FS=1MA" in the lower right. Were these "standard" meters in 50's/60's equipment, or are they later repros made to match the R-390A, or what? I'm merely the custodian of this machine and do not know its history in previous custodian's hands :-).

Date: Wed, 8 Jun 2005 17:33:37 -0500
From: mikea <mikea@mikea.ath.cx>
Subject: Re: [R-390] Sources for meter movements?

You may find that the "Ideal VU Meter" isn't ideal for use as an S-meter or what-have-you in an R-390 or R-390A[1], because the damping on a VU meter is specified rather carefully and isn't the damping you'll see on most anything else.

Date: Thu, 09 Jun 2005 11:11:10 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Sources for meter movements?

The characteristics of a "correct" VU meter are tightly specified in an official specification. Basically:

- 1) the meter must indicate within one percent of "100 or 0 VU" within 0.3 seconds of application of the signal
- 2) The overshoot must be more than 1% and less than 1.5 %.
- 3) The impedance of the meter may also be specified but I am not sure.

Ah yes, I have an RDH4 at hand (Radiotron Designer's Handbook Volume 4). In Chapter 19, Section 2, page 823, I find:

" The Volume Indicator is a root-mean-square type instrument with a copper oxide type of rectifier. The rectifier law is intermediate between linear and square-law, having an exponential of 1.2 +/- 0.2. It's dynamic characteristics are such that if a sinusoidal voltage of frequency between 35 and 10,000 c/s and of such amplitude as to give reference deflection under steady state conditions is suddenly applied, the pointer will reach 99% of reference deflection in 0.3 seconds (+/- 10%) and then should over swing reference deflection by 1% but not more than 1.5%. ... It will give a reading of 80% on an impulse of sine wave form as short as 0.025 second. .. "

The reference given for most of this is: "American recommended practice for volume measurements of electrical speech and program waves" C16.5 - 1942 American Standards Association I think it's unlikely that a small meter such as in the R-390 type receivers could meet these specs. The 0 VU calibration would, but none of the rest.

I have a genuine Weston VU meter about 4" across. It is VERY heavy. I suspect that the large magnet is needed to meet the ballistic specs above.at:

<http://yarchive.net/phone/decibels.html>

I find the author (Al Varney)varney@ihgp2.ih.lucent.com tells his sources for VU meter information: " much of my VU information was from the Bell System Technical Journal, Vol 19, 1940, p. 94-137, "A New Standard Volume Indicator and

Reference Level", by D. K. Gannett (Bell Labs), H. A. Chinn (CBS) and R. M. Morris (NBC). This was also presented at a joint AIEE/IRE meeting in San Francisco (June 1939) and at the IRE Convention in New York (September 1939). Additional material was from the June 1940 Bell Labs Record and several prior documents relating to the Bell System's "program transmission networks" and work of loudspeaker/public-address systems."

http://www.sfu.ca/sonic-studio/handbook/Zero_Level_VU.html

I find: "0 VU is +4 dbm and represents a voltage level of 1.228 volts." Note that 0 DBM in 600 ohms is one milliwatt or 0.733 volts, and no doubt these definitions can be found in many EE texts or engineering handbooks. Roy

Date: Thu, 09 Jun 2005 08:56:57 -0700
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: Re: [R-390] Sources for meter movements?

> "0 VU is +4 dbm and represents a voltage level of 1.228 volts.".....

Boy, not any more - I went through an entire MIT then Stanford Electrical Engineering education without anybody telling me what a dBm was. I had to take a class in the music department (!) to learn that (!!!). I guess building computers and making integrated circuits doesn't need dBm any more. . . The funny thing is that Stanford was the home of Prof. Terman, and the EE building is called the "Terman Engineering Center". Terman was the author of a dozen or so classic EE texts that mostly dealt with building radios. I don't think Stanford has a course in RF engineering any more. I guess with cell phones, wireless internet and RFID the whole subject is starting to come back now.

Date: Thu, 09 Jun 2005 21:18:31 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Re: Panel meters

> BTW I like the 6E5 idea!

One problem with 6E5's or other eye tubes of the winky blinky variety -- the mounting depth needed. One thing would lead to another -- mount the sockets as way back as possible and let the tubes protrude from the meter ports, maybe with protective shrouds. But then the receiver would take on a bug-eyed look, maybe even amphibious. Next thing y'know there would be posts with subject lines reading "Frog '390 Not Yeasu". I guess that means using those sideways tubes, but good ones are probably rarer than original meters. Many moons ago, I built a standalone stereo VU meter adapted from a magazine article for a friend. It was driven off the full output of the power amp -- fairly simple circuit as I recall, but not much else. It was rather large -- on purpose -- so it could be read from a distance. I believe the circuit was basically a linear/op amp type of thing. I suppose a miniature version could be made with LED arrays if available or very small LED's arranged in an arc, like a meter scale. Not sure if the LED's blinking would also make noise. <snip>

Date: Thu, 9 Jun 2005 22:07:13 -0500
From: "Barry" <N4BUQ@aol.com>
Subject: Re: [R-390] Re: Panel meters

I've wondered about "retrofitting" a magic eye tube with the R390A. I bought a 1629 and plan to try it. I realize it won't fit where the Carrier Level meter is, but I was thinking about a "sit-on-top" box. Not fancy and maybe not all the practical, but it would have a cool factor.

Date: Thu, 09 Jun 2005 23:33:17 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Re: Panel meters

Kiwa made one for \$249. The web page is still there: <http://kiwa.com/kiwaeye.html> but apparently no links to it from their product list page, so maybe it's history. A tad pricey.

Date: Tue, 19 Jul 2005 05:56:04 -0700 (PDT)
From: Mark Donaldson <wa1qhq@yahoo.com>
Subject: Re: [R-390] Meter Question

I have already bought some of those meters from ATC and the internal resistance is somewhere north of 1K Ohm which means shunting will give you an internal resistance around 100 Ohms which is if memory serves me about 10 times higher than what you want.

Date: Tue, 19 Jul 2005 10:47:36 -0500
From: "Barry" <n4buq@aol.com>
Subject: Re: [R-390] Meter Question

That's about what I figured. I bought some meters from Leeds Electric that are 100uA full-scale and around 1K. I was hoping these might be different, but probably not. Nice meters if they fit the application, but I can pass on these.

Date: Fri, 23 Sep 2005 15:53:11 -0500
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] Meter Faces - hi res pdf already exists

Pete Wokoun made a set of high res meter faces several years ago in PDF form and they fit perfectly. There's no need to make three or four more sets of meter faces. With Buzz and Pete's there should be more than enough to go around. Are Pete's scans on the "Pearls" site?

Date: Wed, 12 Oct 2005 08:13:57 -0400
From: Mark Huss <mhuss1@bellatlantic.net>
Subject: Re: [R-390] Re: R390A meter movment current.

>What is the meter current What is the nominal or specified full scale current?

The audio meter is a standard 600 ohm VU meter. 0dB is 0dBvu (1mW into 600 ohm load) The Signal Strength meter is a real odd-ball. Worse, its DC resistance is critical to the operation of the AGC. the meter movement is 16.7 to 17 ohms. and full-scale current is xxx.

Jan Skirrow at <http://www.skirrow.org/Boatanchors/> uses an eight-pin op-amp to convert between the meter circuit and the meter you happen to have.

Date: Wed, 12 Oct 2005 08:18:33 -0500
From: "Barry" <n4buq@aol.com>
Subject: Re: [R-390] Re: R390A meter movment current.

I think the FS current on the Carrier Level meter is 1ma. Yes, the rub is the internal resistance.

Date: Wed, 12 Oct 2005 09:28:21 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Re: R390A meter movment current.

That all means that the meter runs on alternating current from the audio line output.

- it has a copper oxide rectifier inside the case
- the actual DC full scale current and series resistance of the meter movement is not too critical

Information I have indicates a one milliamp full scale movement. (Carrier Level)

Date: Wed, 12 Oct 2005 15:34:28 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Re: R390A meter movment current.

I need to thank you all for input on this subject. I am almost sorry I kicked this can of worms. I found some nice looking meters at fair radio to install into my Julian Creek less meters R390A. The meters have the correct look and size. I am now examining the interior guts to see what conversion will be necessary. More to follow.

Date: Wed, 12 Oct 2005 15:41:42 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Re: R390A meter movement current.

For what it's worth, I spent some time mulling over the schematics some time ago and came to the conclusion that unless you are willing to (a) hack the IF deck in a way that makes it incompatible with the stock carrier meter, and (b) put up with some degradation in AGC performance, your only choices are either the stock meter or an amplified one like Jan's. Jan did a fine job, but he worked a bit too hard: as long as the replacement meter can be calibrated to read full-scale under the appropriate conditions, it's not necessary for the replacement meter or circuit to have an 18-ohm impedance. It can be literally anything, from

zero to infinity. The key is the product of full-scale sensitivity and resistance. The circuit generates so little voltage that most meters don't get enough current through them to go full-scale. I don't remember the details now, but I think I worked out how they could have done it in a way that would work with most any meter, but it would have cost them an extra tube, so you know how far *that* idea got.

Date: Wed, 12 Oct 2005 20:52:30 EDT
From: DCrespy@aol.com
Subject: Re: [R-390] Re: R390A meter movement current.

On the 1 mA carrier meter: Looking for replacements over the years, I have found only original meters with 18 ohm internal resistance. I have found several others at swaps and surplus houses, at about 38 ohms. These work fine when compared side by side with an original. AGC seems to work well and the meter deflection is identical in the side by side comparison. They do take a different zero set of course. Some of the "international" brand 100 ohm 1mA meters have an internal series resistor, that when jumpered makes the meter a 38 ohm movement. So they are worth opening, so long as they are not the glow in the dark versions. Note, when you open them, some of the screw/bushings are left hand thread! Good hunting!

Date: Wed, 12 Oct 2005 21:17:26 -0500
From: David M sundheimer <w0nbz@juno.com>
Subject: [R-390] (no subject)

There's an article in Electric Radio some months back that showed how to build a small, simple, IC op amp and use any meter. I've done it and it works great.

Date: Fri, 04 Nov 2005 17:19:16 -0700
From: DW Holtman <future212@comcast.net>
Subject: [R-390] Another 390A Carrier meter question

I'm getting the last parts together and trying to finish up a couple of Blue-Strippers that I got from Fair Radio Sales. My question is about the carrier level meter. I have acquired the correct meter. My question is about the sensitivity of the meter. It reads around mid-scale with 0.1 mv/-73 dbm input on the balanced antenna. Does this sound about right. Most ham receivers are set up for S-9 readings with 50 uv signal. That is usually around 3/4 full scale. I don't think there is a problem with the overall sensitivity of the receiver, it is 1 uv or better. It takes a pretty strong station to get any readable meter movement. Any ideas or suggestions will be greatly appreciated.

Date: Fri, 4 Nov 2005 19:56:51 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Another 390A Carrier meter question

Sad things I have to say. The R390 carrier level meter is un scaled to any standard. Never was. Never was taught in school to be related to any thing. It was just a nifty tuning indicator that let you sort of know when you had the signal in the band pass

or the receiver.

The zero point was never an easy thing to set. It was the only specification for the meter circuit. We never tried to even get them to zero for the operators. We left them laying a bit off the left peg just so that whatever signal did come along was not lost before the needle got off the peg. Some of the guys have used 10 turn pots to get a better zero. Some have used 10 Ohm pots and made up the rest of the resistance with fixed resistors to make the zero a little easier to set.

If you have a signal that puts the needle up about mid scale, you likely can bite down on a chewing gum wrapper and detect the signal in your mouth on one of your fillings. Sensitive the circuit is not. Calibrated is not used in reference to the meter circuit. One side of the meter is set to a small positive voltage by the current drawn through R548. This is a 27 ohm cathode resistor for the AGC time constant tube. When you change the AGC speed, the change in voltage causes the meter to peg. This is all normal. The 5814 sections draws a little less current than the 6AK6 so its 27 ohm resistor balances some where with the resistance in the 6AK6 cathode circuit.

On the other side of the meter the stock 100 ohm resistor shorts a 22 ohm resistor. So the carried meter adjust varies from 0 to 18 ohms. The circuit is a voltage meter to measure the voltage drop across the bottom end of the 6AK6 fourth IF cathode resistor. The tube always conducts. There is always some voltage drop. Placing the other side of the meter against the AGC tube cathode resistor just offers a zero point for zero signal.

Once a signal hits the grid of the 6AK6, the tube conducts a bit harder. A little more voltage is developed across the metered section of cathode resistor and the meter will move up scale. 6AK6's will change in gain with any variable you would like to mention. A calibrated circuit it is not. Nowhere is the developed signal in the receiver run across a fixed resistance and the magnitude of power metered. The line level output meter is as close as you get to a metered signal. This is just the audio level developed and has no calibrated relation to the RF signal strength.

The meter is nice and it functions as designed. **A S meter it was never intended to be.**
Roger KC6TRU

Date: Fri, 4 Nov 2005 20:04:41 EST

From: DJED1@aol.com

Subject: Re: [R-390] Another 390A Carrier meter question

In theory, according to my manual, 0 dB is 1 μ volt, so 20 dB is 10 μ v, and 40 dB is 100 μ volts. So I assume S-9 is a bit less than the 40 dB mark. However, the scale is very dependent on the setting of the IF gain, so unless you calibrate the IF gain to the meter reading, you don't know what you've got. I checked mine and found that the meter was also rather non-linear, so I don't rely on it for accurate signal level measurements. Ed

Date: Fri, 04 Nov 2005 21:12:19 -0500

From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] Another Carrier Meter question

> It takes a pretty strong station to get any readable meter movement.

Maybe it's a measure of noise in my neighborhood, but with any kind of antenna hooked up my R-390A's both register between 20 and 30dB on the carrier meter at 4kHz or 8kHz bandwidth. Big powerhouse SW stations (Deutsche Welle, RCI, etc.) come in between 60dB and 80dB. I've never tweaked the meter or associated circuitry for any kind of calibration, I just adjust R523 for something near zero when there's no antenna hooked up.

Date: Fri, 4 Nov 2005 22:04:55 -0500
From: roy.morgan@nist.gov
Subject: Re: [R-390] Another 390A Carrier meter question

>..It reads around mid-scale with 0.1 mv/-73 dbm input on the balanced
>antenna. Does this sound about right.

Nope. It does not. 0.1 millivolt is 100 μ volts. That might be the RF input voltage needed for mid-scale reading on the meter, but I don't remember the details. If the meter does not go pretty much way up on local broadcast stations using a moderate or longer antenna, it's not reading right.

> Any ideas or suggestions will be greatly appreciated.

1) Get a manual and read the alignment procedure.

2) Do the IF gain adjustment from Chuck Rippel's site before you do the carrier meter adjust.

3) Adjust the carrier meter by the book. Have some idea about your ACTUAL RF input voltage if you like, or just follow the book procedure if you don't need to understand what's really happening at the antenna input jack. Roy

Date: Fri, 4 Nov 2005 22:23:12 -0500
From: roy.morgan@nist.gov
Subject: Re: [R-390] Another 390A Carrier meter question

>The R390 carrier level meter is un scaled to any standard. Never was.....

HAH! Thanks to Roger for setting us straight on this... I assumed there was a calibration for the thing, and that was not a good assumption! (It's been a while since I had the manual open.)

> The zero point was never an easy thing to set..... only specification for the meter circuit.....

True. Those of us who like to set things right and have them stay right are usually frustrated with the zero set. (I LOVE my General Radio stuff!) <snip>

Date: Sat, 05 Nov 2005 12:50:28 +0000
From: "Gene Dathe" <dathegene@hotmail.com>
Subject: Re: [R-390] Another 390A Carrier meter question

Since the carrier meter is of limited utility, I suppose there is a mod out there to add a honest to God real S-meter to our rigs. Where can I find it?

Date: Sat, 5 Nov 2005 08:08:26 -0500
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: RE: [R-390] Another 390A Carrier meter question

I always thought S-meters were nice to have but really of questionable utility. Most signal reports consist of "You're 20 over S-9 here OM, but could you repeat your call and I missed your QTH. On your next transmission would you spell your name phonetically, lots of QSB here."

Date: Sat, 5 Nov 2005 13:28:39 -0500
From: "Michael Murphy" <mjmurphy45@comcast.net>
Subject: Re: [R-390] Another 390A Carrier meter question

Hey, I think it is a pretty good signal strength indicator. It has plenty of utility even if it is not "calibratable". It works like most S-meters that I have used. We need a sticker -

METER NOT FOR LABORATORY MEASUREMENT USE OR SAFETY OF LIFE
WARNING - METER MAY BE HARD TO ITERPRET FOR USERS 50 YEARS OLD
AND YOUNGER CAUTION - R-390 -TRAINED OR AUTHORIZED USERS ONLY

Date: Sat, 5 Nov 2005 16:19:43 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Another 390A Carrier meter question

Well, if you put the age qualifier in there then it could also say:

WARNING: FOR USERS UNDER 30, NO USER SERVICABLE PARTS INSIDE.
or:
WARNING: FOR USERS UNDER 25, NO USER RECOGNIZABLE PARTS INSIDE
or:
WARNING: FOR USERS UNDER 20, GET SOMEONE TO READ THIS LABEL FOR YOU

Date: Sun, 06 Nov 2005 06:39:49 -0500
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] Another 390A Carrier meter question

> It has plenty of utility even if not calibratable. <snip> Very true. I have worked with radio equipment that was calibrated for measuring RF fields in terms of uV/ meter, and it was an extremely convoluted and complex process that nobody would've ever paid for unless it was required by FCC certs :-). I think I exaggerated there a bit, I think that calibrated receivers are used for direction finding etc., but it's worth pointing out that the ANTENNA has to be calibrated too! Not much point if just hooked to a random longwire...

Date: Sun, 06 Nov 2005 09:58:23 -0500
From: "Miles B. Anderson" <mbalaw@optonline.net>
Subject: [R-390] Another R-390A Carrier Meter Question

The easiest way to hook up a "real" S-Meter for an R-390A or any other receiver for that matter is just to pick up the AVC bus and meter it with a very high impedance (preferably 10 Meg) meter. I did this with a GRR-5 and homebrewed a meter amplifier with an FET. It's even easier with an R-390 because the AVC voltage is available at the Diode Load pin on the back panel (or the front panel pin jack if it's a Navy modified unit). If you don't want to compromise your principles, you can build a genuine hollow state meter amplifier (VTVM) with a 12AU7 12AT7 or any other dual triode. Just see look at the print for a Heathkit or EICO VTVM or any tube era ARRL Handbook.

Date: Sun, 6 Nov 2005 07:51:08 -0800
From: "Leigh Sedgwick" <bipi@comcast.net>
Subject: Re: [R-390] Another R-390A Carrier Meter Question

Guess I'm just lucky or something. I did the full IF/RF alignment of my R-390A per procedure then checked the carrier meter alignment using the little XG1 signal generator made by Elecraft (kit). The XG1 is a crystal controlled RF generator that supplies a precision 50uV signal (also 1uV switchable) on 7040 kc at 50 ohms. The carrier meter should read 40dB for an S-9 signal at 50uV per established guidelines. Well, that is exactly what the carrier meter reads. Checked a few other bands using my HP8640B for the signal source and they were right on the money too. BTW, I replaced the carrier meter zero pot on the IF deck with a 10-turn precision pot as recommended by Chuck Rippel. That is a modification I would recommend to everyone. There is no issue with adjusting the carrier meter once that mod is made. The 10-turn pots are readily available from standard sources. Even saw some on the dreaded e-Bay for around \$5. I also did this modification on my Collins 51J4 with similar success.

Date: Sun, 6 Nov 2005 11:24:16 EST
From: DJED1@aol.com
Subject: Re: [R-390] Another R-390A Carrier Meter Question

I agree that the meter is pretty good for reading signal level- at least as good as most S-meters. But I've got to correct one thing- According to my TM 11-856A, which shows the meter reading vs signal level, the meter in theory reads from 0dB at one microvolt, and on up to 40 dB at 100 microvolts. So 50 microvolts (S-9)

should be at 34 dB if the receiver gain is set for the most accurate meter reading. So now we've got three ways to set the IF gain: the manual way for a certain diode load voltage, the Chuck Rippel way to maximize sensitivity, and now the correct meter reading way. And I'll bet none are the same setting. I checked my meter with a good signal generator, and found it off by about 10 dB at 30 dB, then pretty close as I went up towards 60 to 100 dB. When propagation was good a few years ago the strongest SW broadcast stations around 6 MHz could just hit 100 dB.

Date: Sun, 6 Nov 2005 15:44:00 -0800
From: "Bill Feldmann" <n6py@qnet.com>
Subject: Re: [R-390] Another 390A Carrier meter question

On my R-390 non-A receiver I've been having a good time working on and testing it but was a little confused as to the proper setting of the IF gain pot which really controls the accuracy and span of the carrier meter. The carrier meter pot only determines its zero setting. I tried first setting the gain using my HP signal generator input to be 100uv, normally a S9 signal on most older Collins receivers, on 75 meters. I adjusted the IF gain pot for a reading of 60db at 100uv input after zeroing the meter with no antenna input. Then it was easy to give signal reports based on S units as 60db S9 and still had 40db above S9 on the meter for over S9 reports. I then had run some 3rd order intermod and noise floor tests on my receiver.

Later a friend more familiar with R-390's told me the best method of setting the pot was using the line audio meter. First set the pot for full IF gain with no antenna input and then setting the line audio meter for a db reading on the receiver's internal noise using the line audio control. Also the selectivity should be at 16kc during this procedure. Then to adjust the IF gain to drop the line audio meter reading 6db by adjusting the IF gain pot for the proper adjustment.

I tried this method and then used my signal generator to determine the carrier meter reading for 100uv antenna input. It came out around 45db which makes some sense because 0db would be around a 1uv antenna input. After this adjustment of the IF gain pot I repeated my noise floor and intermod tests. I noticed a very slight but hard to detect lowering of the noise floor by only 2db to 3db but the two tone 3rd intermod floor didn't change from the previous test. So this method is slightly better for receiver noise floor performance. But I went back and set the IF gain for 40db with 100uv for easy S unit conversion since I'm a lazy guy.

But as Tim mentioned the R-390 to any old antenna is not a usable field strength measuring method since the antenna is not calibrated. But the meter does seem to be accurate in db by my testing it when changing my signal generator input, so the antenna/receiver system should be good for comparisons. I also found on my R-390 the sensitivity held fairly close after receiver alignment for the bands above 3mc. Collins sure did a nice design job on the R-390. Bill N6PY

Date: Sun, 6 Nov 2005 19:28:43 EST
From: DJED1@aol.com
Subject: Re: [R-390] Another 390A Carrier meter question

I think your friend has an incorrect version of Chuck Rippel's procedure for setting the IF gain. I believe what it does is to set the gain lower in order to improve the sensitivity by reducing the IF noise contribution. The procedure is described on the R-390 FAQ page in the "pearls of wisdom". I don't know how the meter calibration winds up after doing Chuck's thing, but I'd be interested if you try the procedure out and then check the meter calibration.

Date: Mon, 07 Nov 2005 17:03:38 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Another 390A Carrier meter question

I did not get the impression that "the friend" claimed it was "Chuck's Method": here is what the friend apparently suggested: "Later a friend more familiar with R-390's told me the best method of setting the pot was using the line audio meter. First set the pot for full IF gain with no antenna input ..." Perhaps he really meant "set the RF GAIN full on with the antenna terminated by a resistor." Just for the record, here is the procedure from Chuck's site, with the comments in parentheses added by me.. <http://www.r390a.com/html/gain.html>

"Procedure to set R390A IF Gain:

Once the receiver has been fully mechanically and electrically aligned, the final procedure to perform before "buttoning it up" is to set the IF gain control. Many otherwise very sensitive R390A's are thought not to be due to weak signals being covered by noise generated by excess IF deck gain. Allow the receiver to warm up for at least 1 hour then:

- 1- Terminate the antenna input (with 50 Ohms to ground with one terminal of the balanced input grounded, or with 125 ohms across the balanced input.)
- 2- Set receiver for 15.2 MHz
- 3- Set the "FUNCTION" control to MGC
- 4- Select the 4kc filter with the "BANDWIDTH"
- 5- Set "RF GAIN" control to 10 or maximum
- 6- Peak the "ANTENNA TRIM" for maximum noise as indicated on the "LINE LEVEL" meter (Adjust the LINE GAIN control upwards to get a reading.)
- 7- Set "Line Meter" switch to -10db scale
- 8- Set "Line Gain" control to full CW or "10."
- 9- Adjust IF gain control, R-519 to cause "Line Level" meter to indicate between -4 to -7 VU.

10- Re-zero the carrier meter control, R-523

11- Set controls above for normal operation and reconnect antenna.

Discussion: This will yield the best compromise on all bands. I usually "poll" those bands which I normally spec out. Then, using an HP signal generator set for internal modulation of 800 hz @ 30%, "massage" the gain setting and even specific signal path tube selections for the best overall performance." What this does is give you a modest amount of noise with the LINE GAIN and RF GAIN at full. Any signal at or above that level you probably will hear. But no stage in the radio is working harder than it needs to. The IF strip is contributing very little noise to the receiver output. The majority of the noise you hear is from the first RF stage, where it should come from. Adjusting the ANT TRIM for the noise peak assures that this is true. If you get no peak with the ANT TRIM control, you have other things to fix first.

>I believe what it does is to set the gain lower in order to improve the
>sensitivity by reducing the IF noise contribution.

What it does is set the gain of the IF strip to be in balance with the gain of the other stages, and makes sure that the overall gain of the receiver, at full gain, is producing a modest amount of noise, mostly from the front end. Roy

Date: Wed, 17 May 2006 08:50:50 -0400
From: Miles Anderson <k2cby@optonline.net>
Subject: [R-390] AVC Voltages

I think we have two separate questions here. (1) The actual voltage on the AVC line and (2) the behavior of the carrier meter. <snip> The carrier meter is a different story entirely. It doesn't measure the AVC line directly. Instead, it measures the cathode current drawn by the 4th IF amplifier (V504). The cathode current of V504 depends on its grid bias. Since V504 is an AVC-controlled stage, its grid bias is controlled by the AVC line. In short, V504 has two functions.

In its AC mode it is an IF amplifier boosting the 455 kHz signal to drive the detector.

In its DC mode it is a DC amplifier that drives the carrier meter. Result: (1) If the AVC line itself is misbehaving as measured by a VTVM, solve that problem first and look for a leaky bypass capacitor. (2) If the AVC voltage is OK and only the carrier meter is behaving strangely, confine your troubleshooting to V504 and, in particular, its cathode circuit.

Date: Wed, 24 May 2006 17:09:10 +1000
From: "pete williams" <jupete@bigpond.net.au>
Subject: [R-390] Carrier Level meter R-390 A

With replacement meters a bit light on for carrier level, substitutes 1 mA FSD & around 100 ohm IR grudgingly give a useful deflection..... I know about the external amp mod, but has anyone done a 75 A-4 or other type circuit mod for "S" meter that gives satisfactory results with meters with higher internal R. Yeah, I

know I could try it and see, and the purists will wail at the snipping et al, but "when the devil drives, the needs must " It also would save me bit of time !
Thanks

Date: Wed, 24 May 2006 1:05:21 PDT
From: Gary Gitzen <r390a@uwave.com>
Subject: [R-390] Carrier Level meter R-390 A

Pete from Oz wrote of problems finding original 17 ohm carrier level meters, and notes that available 100 ohm meters give at best grudging needle deflection. This prompted a look at the schematic of the carrier meter circuit for the 390A. It's essentially a bridge, balancing currents between the cathodes of V504, the 6AK6 final IF, and V506A, the AGC time constant tube. The resistors in the bridge allow a voltage to be developed across them, based on the currents. Any voltage difference flows through the meter, moving it.

Why not, I asked myself, change resistors R537 & R548 to larger values to allow larger deflection using 100 ohm meters? A quick guesstimate is that removing R537, the 22 ohm 1W across the carrier adj pot, and increasing R548 from 22 ohms to approx 160 ohms should give reasonable results. It might even be appropriate to add a small resistance (22 ohms???) in series with R523, carrier adj, to get adequate adjustment range. Possibly also reduce R524, the 680 ohm 6AK6 cathode resistor, to 600-620 ohms or so. Shunting R524 with 5.1K or 7.5K would give that result.

Can anyone shoot reasonable holes in this idea?

Caveat #1: I haven't tried it.

Caveat #2: If you do this, please document it on both the chassis and the IF module.

Gary, glad both his R-390As have original meters

Date: Wed, 24 May 2006 10:39:58 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Carrier Level meter R-390 A

Since the DC operating point, voltage gain, and plate resistance of V506A are changed, I'd expect some change in the LONG AGC action (MEDIUM too if you are using my AGC mod), but I believe you would not notice. Reducing R524 will preserve the original IF gain.

Since the zero-point meter voltage is in the hundreds of millivolts instead of the tens, getting rid of R537 eliminates the problem with the stock carrier pot where the whole adjustment range is squished into the last 5% of the pot, so my carrier pot mod is obviated. (For its original purpose, at least; see below.)

Because the pot is a larger percentage of the 6AK6's cathode bias resistor, IF gain

is more sensitive to the carrier pot setting than before. This could be ameliorated by rewiring the pot as a pot instead of a rheostat.

The meter's scale factor (as opposed to its zero point) is as sensitive to the carrier pot setting as ever. This effect can be reduced by wiring the pot as a backwards-facing pot (the essence of my mod), but this would make IF gain even more variable. This problem and the IF gain problem could be licked by installing a dual pot in place of the original. Most likely it's not irritating enough to make you do it.

The main objection, in my opinion, is that your deck is now incompatible with the stock meter. Individuals will vary wildly in the importance they place on this, depending on personality and the number of receivers and spare parts they have. If I had exactly one radio, no spares, and no intention of acquiring more, I'd do it. It's very much worth a try, and anyone who does it, please post your findings. Dave Wise (whose radio also has original meters)

PS - It occurs to me that the basic mod could be wired through a switch hidden under the chassis, so you could switch it back to stock before mating it to a 17-ohm meter.

Date: Wed, 24 May 2006 14:20:02 PDT
From: Gary Gitzen <r390a@uwave.com>
Subject: RE: [R-390] Carrier Level meter R-390 A

David Wise gave his comments and insights regarding a possible modification of the R-390A carrier meter circuit to accommodate 100 ohm replacement meters. It prompted some additional thoughts and comments.

>.....<snip> I'd expect some change in the LONG AGC

I pretty much agree on all points, especially that the difference would be hard to see. V506A at this point is acting pretty much as an AGC controlled current source developing voltage across a small R548. The cathode voltage, thus effective grid voltage, will change by maybe 150-250mv if R548 is changed from 27 to 160 ohms. That's an almost trivial grid voltage change. The specific action of the AGC-variable suppressor grid voltage on V504's (6AK6) cathode current is unknown. Can anyone provide insights? Will it result in any significant cathode current change, thus meter action; or is V504 merely a convenient currentsource?

><snip>.....squished into the last 5% of the pot,.....

Yea!!!! And please see below for original meters.

>.<snip>.....IF gain is more sensitive to the carrier pot setting

Excellent suggestion! Please consider my earlier thoughts on the subject so modified. [Translation: Why didn't I think of that? Programmers note: it's called "stepwise refinement" & peer review.]

> Reducing R524 will preserve the original IF gain.....

Yes, and if R523 is rewired as a pot instead of as a rheostat when R537 is removed, R524 (6AK6 cath res) definitely needs to be reduced to around 600 ohms. A 5.1K shunt across it will do this. Carrying David's "pot thought" forward, replacing the R523 & R537 combination with a 20 ohm pot wired as a pot while using an original 17 ohm meter would appear to be a Very Good Thing. [Please see caveat #2.] This raises the following question: were 20 ohm AB pots with 10% tolerance available in 1950-55 for a reasonable price? This circuit appears to beg for one, instead of the R523/R537 kludge.

> The meter's scale factor (as opposed to its zero point).....

This implies that the AGC-variable suppressor grid voltage to V504 does significantly affect cathode current. Thanks for that insight.

>that your deck is now incompatible with the stock meter.....

Absolutely agreed. Please see caveat #2.

>> Caveat #2: If you do this, please document it on both the chasis and the IF module.

Thanks to David for his comments and insights. It's obvious they come from someone who has "been there and done that" as opposed to my theoretical musings. If I had even one R-390A without an original carrier meter, and had on hand a 100 ohm replacement, I'd give it a try. And I'd carefully document exactly what was done, and why, on both chasis and IF module. I second David's request for results from anyone who makes this mod to hopefully allow use of 100 ohm carrier level meters in place of the original 17 ohm meters. Just so it will all be in one place:

Install 100 ohm replacement carrier level meter.

Replace R548, 27 ohms, with 160 ohms (150 ohms if it's all that you have).

Remove R537, 22 ohms.

Replace R524 with approx 600 ohms, or shunt the existing 680 ohm R524 with 5.1K.

Rewire R523 as a pot, with the meter lead coming off the wiper.

If needed to get adequate adjustment range, add 22-47 ohms in series with the ground side of R523 and reduce R524 by the same amount. (39 ohms with R524=560 ohms should work nice.)

Document what you have done, and why, on both the chassis and IF module.

All relevant constructive comments welcome.

Date: Wed, 24 May 2006 15:17:11 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Carrier Level meter R-390 A

Now you did it :) My comments below.

I was thinking of dynamic, not static, behavior. When AGC is set to SLOW, there's a 2uF cap between the plate and grid of V506A, which makes it an integrator, provided the gain is high enough. As the gain drops, it becomes less an integrator and more... something else. Something not wanted, no doubt, but I can't say what, or how much it will degrade the AGC action.

- > The specific action of the AGC-variable suppressor
- > grid voltage on V504's (6AK6) cathode current is
- > unknown. Can anyone provide insights?.....

I hadn't thought of this. I've always believed that the suppressors were being used as cheap diodes to keep the 1.8M(IIRC) B+ bleed into the AGC line from driving it positive under no-signal conditions.

- > > getting rid of R537

Unfortunately, where my mod (applicable to 17-ohm meters only) gave a lot while taking little, you now have an uncomfortable choice: wire it like a standard pot or a backwards pot. The former gives constant IF gain and variable meter scale; the latter gives variable IF gain and constant meter scale. Since in the "pot" configuration the meter scale is no more variable than it used to be, I lean that way, but it disappoints me that you can't have both. That's where I started thinking about dual pots, but as I said, it's probably not worth it. Anyway, the real test is to just settle down at the bench and try it.

- >were 20 ohm AB pots with 10% tolerance available in 1950-55.....

20-ohm carbon pots are (or at least were) just about unavailable; 20-ohm WW's (used in the R-390) are (and were) expensive, which is why they went to carbon. They didn't do it right, though, hence the squish I believe they assigned that corner of the redesign to a naive junior engineer. My carrier pot mod (posted once or twice in the archives) uses the original pot, wired as a pot, but backwards; that is, the 6AK6 cathode current goes to the wiper, and the meter goes to the top and to a shunt resistor to ground. At the expense of imperceptible decreases in IF gain, and meter sensitivity, and an equally imperceptible increase in IF gain sensitivity*, this gives a smooth, linear control over the zero setting, and as a bonus, the meter sensitivity is made constant. I installed this on my radio without removing the IF deck. It's just change a resistor and move a couple of wires. Meter zero is in the center third of the pot.

* That is, the gain changes depending on the carrier pot setting. Was 680-698, now

680-709.

> > The meter's scale factor

Sorry, that wasn't my point at all. The scale factor depends on the series resistance seen by the meter - which changes as you move the carrier pot. The original meter could theoretically see anywhere between 27 and 45 ohms. Add the meter's own resistance, and the circuit has anywhere from 44 and 62 ohms, or a 40% change. The 100-ohm meter sees between 160 and 260 ohms, for a total range of 260 to 360 or... still about 40%.

Date: Wed, 24 May 2006 15:38:58 -0700
From: "Leigh Sedgwick" <bipi@comcast.net>
Subject: Re: [R-390] Carrier Level meter R-390 A

All I know is that I wish I had the insight you guys have when viewing these circuits....I've got a long way to go! I always learn alot from these technical discussions...thanks to both of you.

Date: Wed, 24 May 2006 23:06:45 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Meter conversion resistor question

There has been considerable discussion about using 100 ohm resistance replacement meters. My question is does one really need the original style carbon comp or WW pots? At the time these radios were designed the trim pot hadn't been designed. What is the actual power dissipation of the circuit? Could one use the cermit trimmers that are available or a fixed resistor and a cermet trimmer? They are much less expensive and much more available. Education appreciated.

Date: Thu, 25 May 2006 09:14:20 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] R-390A meters

Pete, I have a request. I am very curious as to how this will affect the AGC action and the meter reading, and I'd like it to be as scientific as possible. If it's convenient and interesting, please do the following:

A. Before the mod

1. Set the IF gain to the manual's standardized value.
2. Set up an emulated carrier meter out of an 18-ohm resistor with a sensitive voltmeter across it. Record the exact resistance.
Zero the "meter".
3. For 10dB signal increments from (undetectable) to 90dB above that, record
(a) the AGC voltage, and (b) the meter reading. Also record one of the signal levels (from the generator's point of view) so you can reproduce it later.
4. Scope the AGC line. For one of the above 10dB transitions, measure the

AGC time constant in the SLOW position.

B. The mod

1. Record the coil resistance of your substitute meter.* (We've been saying 100 ohms, but a quick look around the net shows that this is arbitrary. I saw everything from 18 ohms to 1K.) That way, those who find something different can (provided it's lower) simply add series resistance and use your findings without repeating the experiment. With that in mind, it might be a good idea to pad your own meter to some reasonable value (150 ohms?) if it's one of the low ones. * Don't use an ohmmeter! Unless you know for a fact that it puts out $\leq 1\text{mA}$.

C. After the mod

1. Set the IF gain to the manual's standardized value.
2. Using the same signals as step A3, record both:
 - (a) the AGC voltage, and (b) the meter reading.
3. Scope the AGC line and measure the time constant.

Actually, this setup will also help you establish the resistor values for best accuracy and linearity.

Date: Thu, 25 May 2006 19:36:14 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] RE: Carrier Level meter R-390 A

On the topic of using a meter having a different internal resistance to replace the original carrier level meter, Gary Gitzen wrote:

>It's essentially a bridge, balancing currents between the cathodes of V504,
>the 6AK6 final IF, and V506A, the AGC time constant tube. The resistors in the
>bridge allow a voltage to be developed across them, based on the currents.
>Any voltage difference flows through the meter, moving it.
>Why not, I asked myself, change resistors R537 & R548 to larger values to allow
>larger deflection using 100 ohm meters?

Fair Radio performed that type of modification when they installed non-original meters in R-390A's for sale a few years ago. If someone in this forum has one of those radios perhaps they might comment on the carrier level meter's performance. Possible change in response of the AGC integrator (AGC LONG) when changing bridge resistors has been mentioned. Those who have performed the complete Lankford AGC modification need not worry; his complete mod does away with the integrator and substitutes a 20 uF (IIRC) capacitor in the AGC LONG mode. In another posting, Gary wrote:

>The specific action of the AGC-variable suppressor
>grid voltage on V504's (6AK6) cathode current is
>unknown. Can anyone provide insights? <snip>

Perhaps that was done in providing for another carrier level meter function, one that many of us have forgotten: indication of IF last stage (6AK6) overload when in the

MGC mode.

Dave Wise wrote:>My carrier pot mod
>(posted once or twice in the archives) uses the original pot, wired as a pot, but backwards; >that is, the 6AK6 cathode current goes to the wiper, and the meter goes to the top and to a >shunt resistor to ground.

I performed this mod and like the stability it has given the s-meter zero setting. A few years ago someone posted an op-amp circuit which permits the use of many different types of meter without having to modify the original bridge circuit. It was constructed on a small piece of perfboard and mounted on the meter terminals. It borrowed power from the nearby frequency readout pilot lights. It presented a resistance to the bridge circuit that was the same as the original meter's. The op amp circuit got me to thinking of variations on the board-mounted-to-the-meter theme. The op-amp could be configured as a buffer with high input impedance, and be connected to the AGC line instead of the original bridge circuit. The overload indication would be lost but how many of us would care and how many of us even use the radio in the MGC mode enough to require that indication? The main advantage would be flexibility in meter selection and stability of meter zero setting. Unless, of course, the no-signal AGC voltage varies because of drift in that delayed AGC B+ bleed into the AGC line... Drew (who also has genuine original glow-in-the-dark meters in his radios)

Date: Thu, 25 May 2006 17:09:04 PDT
From: Gary Gitzen <r390a@uwave.com>
Subject: [R-390] RE: Carrier Level meter R-390 A

> Fair Radio performed that type of modification

I second that request, and make one of my own: could you also inspect the IF deck (requires removal, sigh) and let us know the values of R548 & R537, the internal resistance of the replacement meter (be very careful here), and the content of any annotation added by Fair to the radio or IF deck?

Date: Mon, 19 Jun 2006 22:40:00 +1000
From: "pete williams" <jupete@bigpond.net.au>
Subject: [R-390] Fw: R-390A carrier meters

Hi... While some of you guys have been getting legless from taking the plate caps off 807's, some of us at the other end of the day have been active in being practical in adapting surplus meters for the carrier level function in R-390A. The original meter has an internal R of around 10 Ohms and the replacement meter I have (ex W5cab) has an internal R of around 103 ohms. It has a FSD of 1 mA. The scale plate changed per foto details available on the net. Altho' it deflects, the reading is a fraction of the original. Following suggestions made by David Wise and Gary Gitzen, modifications made to the meter bridge circuit gave identical results to that generated with original meters - Not only was meter deflection approximately the same (Even readings from original meters varied under same test conditions) but the parameters of linearity and AGC also

remained identical to readings obtained with the original meters during the tests. Time constant values also appeared to be the same as original. MODIFICATION..Refer to Fig 22 on page 36 of manual TM 11-5820-358-35. Replace R524 with a 600 ohm resistor. Replace R548 with a 160 ohm resistor . Both are easy to get at. Remove R537 a 22 ohm resistor from the carrier meter adjust pot .. Remove the shorting link from the center wiper terminal of this pot and connect the white- blu -orange wire to the "hot end" of the pot . The white- blu - green stays on the center wiper and it is already connected to the + side of meter M102. The white wire stays going to chassis.

Zero the meter as per the manual and that's it. NOTE.... other meters of greatly differing IR's may require modification of the resistor values... none were available for test. Thanks to Dave and Gary for interest and assistance with these modifications. Purists can get on with evacuating 807's !

Cheers
Pete D . Williams
METUNG 3904
Australia
jupete@bigpond.net.au

From: On Behalf Of William G Feldmann
Sent: Wednesday, August 16, 2006 01:20 PM
Subject: Re: [R-390] R-390 (Non A) Problems

<snip> Also be sure the carrier meter just isn't pinned below zero. That meter zeroing pot trouble some and is very hard to adjust. I usually replace it with a ten turn one. I'll mention that in my part 2 article in the Sep. issue of ER. Hopefully nothing has damaged the meter because stock ones are very hard to fine thanks to the demil process most have gone through. <snip>

Date: Fri, 08 Sep 2006 16:06:40 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] Meter

Some meters have a thin formed metal cover-like thing that goes over the meter itself. I would call that the bezel. Most meters have a cast and machined front plate into which the meter case is held with either screws or a fastening ring. You could also call that the bezel, since it surrounds the meter glass and face.

Date: Fri, 8 Sep 2006 16:44:57 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Meter

If all you need is the he outside black bezel, the glass, a gasket, a back cover, Then give Fair Radio a call. They sell a "SWR' kit with the SWR part and a meter. There was photos in the 2005 catalog. The meter case is an exact match for the R390 and R390/A meters The meter movement has a different resistance than the R390 or R390/A meters and of course different meter scale. But parts is parts and the case

is a match for the R390 meters.

Date: Fri, 22 Sep 2006 15:55:51 EDT
From: W9zr@aol.com
Subject: [R-390] Low Carrier Level Meter Reading

I recently purchased a low mileage original 1967 EAC R390A. It has not been touched and all the modules and tubes are original and it seems to play well. I have checked all the tubes and replaced a few gassy ones. With 0.1uv from my HP signal generator I can hear the signal fine which means that the sensitivity is very good. However, with 100 mv from the generator the carrier level meter reads 20 db which is way too low I believe. What would be a typical meter reading for this level of signal? Is there an adjustment for this other than the gain adjust pot on the top of the IF deck? I am a newcomer to the 390A <snip>

Date: Fri, 22 Sep 2006 16:57:52 EDT
From: DJED1@aol.com
Subject: Re: [R-390] Low Carrier Level Meter Reading

Meter reading sounds low to me. In theory, 0 dB on the meter should correspond to 1 uV, 20 dB is 10 uV, etc. So 100 dB should be 100,000 uV. I doubt that most meters are all that precise, but it probably should be within 20 dB. I also get 40-50 dB on the calibrator signal. It could be low IF gain, or a bad meter. Are you sure you have original meters in the radio? Some substitutes lack sensitivity.

Date: Mon, 02 Oct 2006 17:53:13 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] Re: 25-ohm pot

>I'm looking to buy a MILSPEC 25-ohm pot of.. <snip>

One can achieve the same result by paralleling the existing pot with a lower fixed resistor. I jumped mine with 8 ohms, IIRC. Dave Wise some time ago came up with a slick simple modification to the s-meter zero circuit to give stability of adjustment. Check the archives or Wei-i Li's "Pearls of Wisdom" at r-390a.net

Date: Wed, 22 Nov 2006 14:51:56 +1100
From: "pete williams" <jupete@bigpond.net.au>
Subject: [R-390] Meter repair/RF xfmr repair

1. A couple of comments--- might be useful to the intrepid. I have a carrier meter Simpson brand that, unusually, had the 2 screws holding on the scale plate very loose and hindering the meter needle. Getting to it meant disassembly via the front and seeing that meter is labelled 'sealed do not open', this provided a challenge. Removing the 8 screws from front gives access to the dial glass which of course is firmly fixed. Figuring that if the meter is sealed it should have air within. Application of the hot air gun might expand the air; loosen any glue and the glass might pop out. It did. --- screws tightened, glass replaced and the next generation or two won't know the difference. Maybe someone has a better idea, although

most folks won't be wanting to open meters. <snip>

Date: Tue, 23 Jan 2007 21:57:56 -0600
From: "Barry" <n4buq@knology.net>
Subject: [R-390] Carrier-level adjustment pot?

Can someone tell me which 10-turn pot they've used to replace the carrier-level pot in the R390A? I ordered one, but the little solder tabs are pretty small. Considering two of the original pins had two wires running to it, one of which is the 1W resistor, the holes in this pot aren't really big enough for the job. I think I ran into this with my first replacement in my other radio and I ended up soldering to the resistor lead and/or jumper wire, but don't remember. Is there a pot that has holes big enough to do the job and will still fit under the housing?

Date: Tue, 23 Jan 2007 20:04:47 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] Carrier-level adjustment pot?

I think in the archives someone posted the Clarostat 73JA 100 ohm 2 watt ten-turn pot was the real McCoy.

Date: Tue, 23 Jan 2007 23:18:26 -0500
From: "Jim M." <jmiller1706@cfl.rr.com>
Subject: Re: [R-390] Carrier-level adjustment pot?

I have used the Vishay/Spectrol 10-turn pot available from Mouser. This is the one I recall using (it's been a few years): Data sheet:

<http://www.mouser.com/catalog/628/548.PDF>
Mouser part number for 100 ohm pot: 59453411101

The 10 turn pot will give much better zero adjustment and won't drift like a single turn pot. It's just small enough to fit under the bracket on the IF module.

Date: Wed, 24 Jan 2007 07:48:11 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Carrier-level adjustment pot?

A single turn pot below 10 ohms is a reasonable alternative. You need to fiddle the resistors a little but it works just fine.

Date: 24 Jan 2007 14:18:16 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: Re: [R-390] Carrier-level adjustment pot?

I looked for a 20-ohm, single-turn pot but was unable to find one that would fit. I ended up with a pot from ETI systems I ordered from Mouser (P/N 882-MW22B-10-100). It is similar in size but has an all plastic housing whereas the Clarostats have a partial metal housing. It appears the lug sizes are about the

same, though. I suppose I'll be able to make this one work.

Date: Wed, 24 Jan 2007 10:51:05 -0800
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Carrier-level adjustment pot?

This approach employs the technique programmers refer to as "brute force and ignorance". It fixes the symptom but not the problem. I discovered a simple wiring change that makes the original 100-ohm pot behave. You don't have to remove the IF deck. See my 10 Feb 2003 post, archived in the Panel Meters chapter of Wei-i Li's "Pearls Of Wisdom", at <http://www.r-390a.net>, on the References page.

(In May and June of 2006, Gary Gitzen and Pete Williams expanded this concept to accomodate replacement meters in the 100-ohm range vs the original 17-ohm units. Their posts are in the same file.)

Date: Tue, 13 Mar 2007 00:53:22 +0100
From: "Henry Meiseles" <meils@get2net.dk>
Subject: [R-390] R-390A Carrier Level meterindication drifts upward during set warmup

The zero signal indication on my R-390A (Amelco, Inc.) climbs up to a zero signal level of 40 dB after about 15 -20minutes from turn on. Haven't yet made any effort to measure my way to the fault source. If anyone has experience remedying this problem please let me know.

Date: Tue, 13 Mar 2007 08:56:29 -0400
From: Mark Huss <mhuss1@bellatlantic.net>
Subject: Re: [R-390] Measuring tangential sensitivity

Bill, you are right. It's most common use is to test the Signal to noise ratio of video and wideband amplifiers and detectors. It is also used in Cable TV Amplifiers. And in Radio Telescopes. It is not often used in HF receivers because there is no way to really adjust the system noise floor in them. The R-390 and R-390A, with their IF Gain adjustment which not only adjusts the total receiver gain for matching purposes, but also has a large effect on the receiver noise floor, are exceptions to this rule. I first ran across this technique at Capitol Cable in Austin back around 1972. I was reintroduced to it again when being trained to repair R-390's in ASA School. And later when doing VHF/UHF and Satcom systems. Before you reject it out of hand, give it a shot. The only thing you are adjusting is the IF Gain pot. It is easy enough to adjust it back if you find it does not help your receivers noise floor.

Date: Mon, 04 Jun 2007 05:56:32 -0400
From: Roger Gibboni <rgibboni@lmdulye.com>
Subject: RE: [R-390] Meters for R390A

>.....I am looking for a set of meters for my R390A.

They are tough to find. There are a few good looking replacements that you can

use but the problem is that the carrier level meter impedance is 17ohms. Anything other than this and the darn thing won't work. I suppose you could make a small op-amp circuit that mounted behind the meter but a standard 1 ma movement won't work. The s meter circuit uses a bridge design and depends on the meter's impedance.

Date: 4 Jun 2007 14:06:22 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: RE: [R-390] Meters for R390A

Jan Skirrow has a good article on this: <http://skirrow.org/Boatanchors/TechTalk2.pdf>

Date: Fri, 8 Jun 2007 11:14:03 -0400 (EDT)
From: "Paul H. Anderson" <paul@pdq.com>
Subject: Re: [R-390] R-392 meter

> Does anybody know if an R-392 carrier meter will work in a R-390xx.

The R-392 meter is nominally 27 ohms, whereas the R-390 meter is nominally 17 ohms. Both are 1mA full scale. The scale of most all R-392 meters that I've seen are slightly different than the R-390 meter, which is marked exactly 0-100. I may be able to dig up a spare working R-390 carrier meter and trade if you'd like. I have to check what I've got and what I need. Let me know off list if you would like to consider that.

Date: Mon, 27 Aug 2007 17:18:32 -0400
From: "Keith Densmore" <densmore@idirect.com>
Subject: [R-390] Meter Faces

Someone has a set of scanned images on the web of the original '390(A) meters but I be darned if I can find them. Does anyone remember their location?

Date: Mon, 27 Aug 2007 15:26:46 -0600
From: "ANTHONY CASORSO" <canthony15@msn.com>
Subject: RE: [R-390] Meter Faces

Try here: <http://www.r-390a.net/faq-refs.htm#Drawings>

Date: Tue, 21 Aug 2007 16:42:31 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: [R-390] Call for measurements - 100dB carrier reading

I'm working on a writeup of a mod I did to my R-390A a few years ago to improve the carrier zero adjust pot. It worked beautifully, but as I gathered data and did more experiments, I realized that it implicitly relies on a characteristic of my radio that seems at variance with the manual. Before I send it to Perry Sandeen, I'd like to find out if it's worth the paper it's printed on. If my radio's the only one it works on, there's no sense in putting it out. A while ago I asked for AGC measurements on an R-390. Now I'm looking for similar info on the R-390A. Specifically:

- Zero your carrier meter
- Apply 1450KC to the balanced antenna input
- Tune the radio to the signal, including antenna trim
- Set the input amplitude to 100mV
- Tell me the carrier meter reading
- If you feel like it, measure the AGC with a VTVM
- For extra credit, set the gen for 100dB carrier indication and tell me the AGC voltage

Be careful that you are actually putting in 100mV - the radio's impedance varies all over the place. I tee'd a RF voltmeter into the line. I hope I hear a lot of "Couldn't read it, it was pinned." Then I can pull off a great trick. If not, then I can't get away with it and have to settle for merely good. Why 1450? Because it's what I happened to use. This week I'll try some other frequencies. Roger, you've seen thousands of these radios. Do you think I have a chance?

Date: Wed, 22 Aug 2007 10:08:43 +0100
 From: "Graham Baxter" <graham@delphe.co.uk>
 Subject: Re: [R-390] Call for measurements - 100dB carrier reading

EAC R-390A SN 189; HP8640B generator, cable through terminated with 50 ohm load at an HP 3400 rms meter. Short coax to balanced input, one side grounded. DC Meter 10 M input resistance

100mV	99dB	11.18V
10 mV	84dB	9.60V
1 mV	69 dB	7.41V

Voltage for 100dB = 11.20-ish but the meter reading is very compressed in this region

Date: Wed, 22 Aug 2007 11:01:44 -0700
 From: "David Wise" <David_Wise@Phoenix.com>
 Subject: RE: [R-390] Call for measurements - 100dB carrier reading

Thanks for the data point, Graham. It is close to what I expected from my carrier meter mockup and the original carrier meter circuit in my radio. On the other hand, your AGC is sharper than mine, even with my sharpest 6DC6. At 100mV in, I average in the low 13's. I must have unusually wide-cutoff tubes, or gobs more gain somewhere. I wish you were local so we could swap stuff around. If others duplicate your findings, then my cute trick is a fluke. It's still worthwhile, but most people will have to go inside their IF deck. I'll start modifying the writeup. <snip>
 PS: I tried all bands last night and found that 0 and 1MC have the least AGC for a given input. I also confirmed that 8 and up require noticeably more AGC due to having one less gain-controlled tube in the chain. Although the meter reads higher, this doesn't mean the gain is up, nor the signal.

Date: Wed, 22 Aug 2007 19:39:10 +0100
 From: "Graham Baxter" <graham@delphe.co.uk>

Subject: [R-390] Call for measurements - 100dB carrier reading

I would urge you to test three things. One is the DC resistance of the AGC amplifier anode coil, Z503, should be no more than 17 ohms and peaked for max AGC voltage.

Second, with the multipin connector off the RF deck, check the DC resistance to ground from pin E, positive probe to ground. This should be about 1.8 Meg at any voltage up to 250.

The third thing is to test the DC leakage resistance of the AGC line in the IF module. Unplug the IF multipin connector. From pin 6 of the connector on the IF module to ground I see about 50 Megohms once all the capacitors have charged. This is with 250v test potential, again with the positive potential to ground. Any significant leakage here will mess up the AGC, and sadly a potential culprit is one or more mechanical filters. Lets hope not.

I have a second EAC here. It is slightly less convenient to check the levels on that one because it is not near the test equipment. If it becomes important, let me know and I will check it. However, on broadcast signals it gives very similar S readings to the one I measured. I have to say, I have no complaints about the standard R-390A metering and AGC circuit. The zero pot is a bit twitchy but once set mine tend to stay put. Is it possible you have a fault? One item of interest might be the diode load voltage. With the measured 100mV unmodulated at 1.45MHz its about 14v

Date: Wed, 22 Aug 2007 14:02:48 -0700

From: "David Wise" <David_Wise@Phoenix.com>

Subject: RE: [R-390] Call for measurements - 100dB carrier reading

Thanks for your debug tips, Graham. I will check tonight, time permitting. Right now all I can do is comment.

1. Any trouble in Z503 or the AGC amp in general (besides runaway oscillation which would be obvious) would lessen my AGC, not increase it. I'll measure it anyway, since I've seen a lot of posts about it.
2. Yes, if R201 (270K, top leg of V201 AGC divider) were to increase, or if R234 (1.5M, bottom leg) were to decrease (but that's rare), V201 would get less than usual AGC, forcing the control loop to throttle down the other tubes more. A similar effect would occur if V201 were absorbing electrons at pin 1, but I tried four different ones that also test good, so I can rule it out. On the other hand, V203 (2nd mixer), and V204 (3rd mixer) have high-impedance grid returns and could do the same thing. (So does V202, 1st mixer, but my peculiarity happens above 8MHz as well as below.) These are easy to check: drive the AGC bus negative, kill the oscillator, and measure between the grid test point and the AGC bus. Should be zero.
3. AGC leakage is unlikely to be towards anything but ground, which would lessen the voltage not increase it, and I have replaced C551, the usual culprit, but I'll check anyway to get early warning on filter trouble.

4. Thanks, I'll check over my own radio first.

5. The design is poor. The R-390 had a 15-ohm wirewound pot, and its cost and complaints about its coarse adjustment granularity led to use of a carbon pot in the R-390A. The smallest practical value was 100 ohms, and some unimaginative junior engineer tacked a 22-ohm resistor across it to make it look like 15 ohms. But the whole R-390 adjustment range is squeezed into the bottom end of the carbon pot, and at the nominal setpoint, change is magnified tenfold, so the slightest scratchiness (like mine) is unbearable. I have a keen interest in design and low tolerance for kluges, especially unnecessary ones. This one really irritates me.

6. I'll compare my diode load voltage to yours although any discrepancy would be caused by the AGC amp, 4th IF amp, IF cathode follower, AGC rectifier, or detector, none of which can exaggerate the AGC voltage.

I'm betting on R201.

Date: Thu, 23 Aug 2007 11:42:53 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Call for measurements - 100dB carrier reading

I only had a moment before work. More later.
Resistances with the RF deck unplugged.

RF resistors:

R201 281K
R233 466K
R234 1.45M
R202 229
R203 77.6K
R204 10.2K
R205 2.33K

2nd mixer resistors:

R214 28
R213+R206 1.06M
R215 2.38K
R216 2.43K

3rd mixer resistors:

R230 31
R217 450K
R215 2.33K
R219 2.38K

With the innocuous exception of R230, they're all in spec. I'm surprised at the number that read low; I'm used to carbon comps going high. I checked with a second DMM, all same. Oh, and Z503 was 13.5 ohms. Next I'll measure resistors on the IF deck, then power the set up without oscillators, elevate the AGC line, and look for current. Finally I'll measure diode load voltage for you, then substitute tubes in the signal chain. Could you take an additional measurement? With your IF gain set to the stock value (150uV for -7V diode load in MGC mode), please apply 100mV to the IF deck in AGC mode and measure the AGC voltage. This will reduce the problem to RF or IF. I hope :)

Say, I forgot to ask what you measured the AGC with. A 10M DVM like me? Just making sure.

Date: Thu, 23 Aug 2007 21:00:07 +0100
 From: "Graham Baxter" <graham@delphe.co.uk>
 Subject: Re: [R-390] Call for measurements - 100dB carrier reading

I can confirm that I used a DVM with a 10 Meg input impedance. Can you clarify; do you want the 150uV applied to the input of the IF module? If so, would you like me to arrange the 150uV across a fifty ohm through termination and assume the loading of the IF is negligible? I ask this because I can't easily measure 150uV in other than 50 ohms.

Date: Thu, 23 Aug 2007 13:11:31 -0700
 From: "David Wise" <David_Wise@Phoenix.com>
 Subject: RE: [R-390] Call for measurements - 100dB carrier reading

I'm alluding to the standard TM11-856A procedure for setting the IF gain. You put 150uV 455kHz into J513 in MGC, and set R519 for -7V on the Diode Load terminal. Doesn't matter how you achieve 150uV; I did it by putting in 1.5mV (which I *can* measure) then turning the gen down 20dB. That gets you around the termination uncertainty. Setting the gain is just to ensure we are comparing the same thing. The open-loop IF gain affects the closed-loop error aka AGC. For the actual AGC measurement, put in anything you want, really; I'll follow and compare. 100mV sounded convenient.

Date: Fri, 24 Aug 2007 11:15:07 +0100
 From: "Graham Baxter" <graham@delphe.co.uk>
 Subject: Re: [R-390] Call for measurements - 100dB carrier reading

HP8640B generator, through terminated in 50 ohm. Plugged to J513 with J518 disconnected. Voltages are PD across 50 ohm.

Input PD	RF DECK UNPLUGGED		RF DECK PLUGGED IN		MGC
	Diode load	AGC	Diode load	AGC	Diode load
150uV	-5.6v	-450mV	-5.6-	289mV	-7.0v
1mV	-6.9v	-3.3v	-7.9	-2.95v	-44v
10mV	-8.5v	-7.5v	-9.9v	-6.9v	-103
100mV	-11.3v	-13.6v	-13.5v	-12.8v	-79v (O/L)

In addition, with the RF deck plugged in, I dropped the AGC rear panel link. I measured the open loop AGC voltage developed with the function switch at AGC.

150 uV	-1.3v
300 uV	-14.5v
1mV	-29.1v

Date: Fri, 24 Aug 2007 12:54:41 +0100
From: "Graham Baxter" <graham@delphe.co.uk>
Subject: [R-390] Call for measurements - 100dB carrier reading

It looks like my attempt to format those results as a table has been a total disaster. I'll try again: 4kHz IF bandwidth, RF gain control fully clockwise, IF gain set to -7v at 150uV

With RF deck UNPLUGGED
Function switch to AGC

150uv, Diode load	-5.6v,	AGC	-450mV
1 mV, Diode load	-6.9v,	AGC	-3.3v
10mV, Diode load	-8.5v,	AGC	-7.5v
100mV, Diode load	-11.3,	AGC	-13.6

With RF deck CONNECTED:
Function switch to AGC

150uv, Diode load	-5.6v,	AGC	-289mV
1 mV, Diode load	-7.9v,	AGC	-2.95v
10mV, Diode load	-9.9,	AGC	-6.9v
100mV, Diode load	-13.5,	AGC	-12.8

With RF deck CONNECTED:
Function switch to MGC

150uV, Diode load	-7.0v
1mV , Diode load	-44v
10mV, Diode load	-103v
100mV, Diode load	-79v, overloaded

With RF deck CONNECTED:
Function switch to AGC
AGC rear panel link open

150uV,	AGC	-1.3v
300uV,	AGC	-14.5v
1mV,	AGC	-29.1v

Date: Fri, 24 Aug 2007 09:45:18 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Call for measurements - 100dB carrier reading

Thanks, Graham, that's an embarrassment of riches! Correct me if I'm wrong: you

are always injecting signal on J513, and the "RF Deck unplugged" group was taken with P108 unplugged. That will change the IF readings only insofar as the load on B+ and the AGC line changes. My comparable readings were

With RF Deck CONNECTED: Function switch to AGC
100mV, Diode load -10.0, AGC -13.9

With RF deck CONNECTED: Function switch to MGC
150uV, Diode load -7.0v

My low diode output suggests that I have a flat 6AK6 or other trouble in that vicinity, and it has led me to set my IF gain higher than yours. I will take a new measurement tonight with IF gain set so my "AGC link open" readings match yours. Could you do one more reading group along those lines, but not only with the link open, but with the downstream terminal grounded, to ensure that the grid returns are actually at 0V? I'll take a reading and measure the grid returns too, with a non-loading meter. (Fluke 895A or 877A Differential Voltmeter, or Fluke 8600A DMM on 0.2V or 2V DC ranges.)

But this is a side issue; my low diode output does not explain why my AGC is more than yours when I run with my IF gain turned down for optimum S/N. Here are this morning's readings, but first a correction to yesterday. In the 3rd Mixer column, I had "R215 2.33K". That should be R218.

1st IF
R501 21.9K
R504 670
R505 29.6K
R506 22.9K
R508 2.29K

2nd IF
R507 21.7K
R513 113
R514 73K
R515 24K
R521 2.12K

3rd IF
R516 22.5K
R518+R519 530 (4K for optimum S/N)
R550 77K
R520 27K
R551 2.15K

R514, R515, R550, and R520 require a "guarded" measurement, where you elevate B+ to match the ohmmeter output so that the only current is through the resistor being measured. (Some bench DMMs have provision to do this automatically.) Everything is more or less within spec except R504, which is high or

low depending on my deck's mod level.

Date: Fri, 24 Aug 2007 20:39:54 +0100
From: "Graham Baxter" <graham@delphe.co.uk>
Subject: Re: [R-390] Call for measurements - 100dB carrier reading

Interesting stuff. I am still waiting to hear the verdict on R544. I think it controls the set-point for the AGC servo. I can confirm that for the measurements I adjusted my IF gain for -7V with 150uV into J513 set to MGC. This produced a somewhat higher setting than I would normally use. By "RF deck unplugged" I meant the RF multipole connector. I think probably the most useful measurements I gave you were the open loop AGC voltages.

I have repeated them with the downstream AGC line grounded

30uV 0.1v
100uV 0.2v
150uV -1.6 (This has changed, probably related to warm-up time).
300uV -14.4
1mV -29.1

Grounding or floating the AGC line makes hardly any difference.

I did one final test which might tell us something. Loading the open-loop agc source line with a 510k resistor pulled it down (strictly speaking, up) from -28.8 to -18.8 (10v). A 1 meg pulled it down by 6v. A 2.0 meg by 3.2v. These measurements were taken with a 10Meg multimeter already loading the AGC source. This time I won't put the covers back on until I hear from you!

Date: Sat, 25 Aug 2007 12:46:36 +0100
From: "Graham Baxter" <graham@delphe.co.uk>
Subject: Re: [R-390] Call for measurements - 100dB carrier reading

Just to clarify, all my openloop AGC voltages were negative. I omitted the - sign on the first two measurements. OK, I did put the covers on. I swapped radios; I am now on as close to mint an EAC as I have ever seen. This one is serial 8016 on the rear panel. I have repeated the diode load and the open loop AGC measurements. Again I calibrated the system to read -7.0v diode load at 150uV IF in.

30 uV,	diode load -1.65 V,	AGC -449 mV
50 uV,	diode load -2.5 V,	AGC -453 mV
100 uV,	diode load -4.5 V,	AGC -498 mV
150 uV,	diode load -7.0 V,	AGC -2.98 V
300 uV,	diode load -13.29 V,	AGC -15.22 V
1 mV,	diode load -40 V,	AGC -26.7

This receiver has a much more well defined AGC knee. It seems to kick in between 100 and 150 uV. It lifts to 1.0 V at 130 uV.

Date: Tue, 28 Aug 2007 10:08:30 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Call for measurements - 100dB carrier reading

(There's a question for all of you at the bottom.) Thanks for all the info, Graham. Except for R504, all my resistors are within tolerance. I was able to duplicate your AGC voltage by substituting tubes. It appears that my gain-controlled IF signal chain (V501, V502, and V503) has a wider cutoff characteristic than yours. (For the record, they are JAN Sylvania 5749W's.) I substituted 6BA6's that have sharper cutoff and about the same gain. This, plus a new 6AK6 (so my IF gain is normalized lower) got my 100mV AGC down from 14-something to 12-something. My AGC amp, V508, has unusually high gain. After replacing it with my weakest spare, and putting in my sharpest 6DC6, I got -11.8V . (I also tried substituting mixers; they affect the gain curve very little.) So there you have it - it was just normal variation.

Quick recap of factors that can contribute to low AGC when the circuit tests okay and the IF gain is normal.

1. Low RF deck gain: weak 6DC6, 6C4's, or 6AK5's, or misalignment.
There's less output than normal which results in less AGC.
2. Sharper than normal cutoff 6DC6 or V501-V503 6BA6.
A given AGC is unusually effective in reducing the gain.
3. Weak V508 6BA6 AGC amp.
For a given output, less AGC is developed.

Diagnostic tip: for a given 6AK6 and AGC voltage, unusually high diode load voltage points to a weak V508. The manual's procedure for setting the IF gain depends on uniform 6AK6 gain. Since 6AK6's are not all alike, every deck will in fact be different, as far as the gain control loop is concerned. If the goal is to achieve uniform AGC action, it would be better to normalize the IF OUTPUT level. (No doubt this was not done because (a) it would require more test equipment, and (b) it wasn't worth the effort.) But this doesn't help; since 6BA6's vary in their cutoff characteristic and (V508) gain, every deck would be different even if the 6AK6's weren't. The R-390x is not a voltmeter; we should not expect every set to read the same. The carrier meter is an approximation only.

With that in mind, how many of you would adopt an extremely simple (no module removal) carrier zero mod that, in the worst case, drops the reading by 3dB? Doesn't change the gain or S/N, just the meter.

How many would adopt a more complicated mod (change a couple resistors under the IF deck) that doesn't drop the meter ever, and in addition makes nonstandard substitute meters read right?

Date: Tue, 28 Aug 2007 15:17:31 EDT
From: Flowertime01@wmconnect.com

Subject: Re: [R-390] Call for measurements - 100dB carrier reading

Could a diode and cap be used to make DC from the 6.3 volt filament line? Then a resistor and LED with its voltage drop from this new DC source be used as a reference voltage to R523 the Carr Meter Adjust. I'm thinking about 1.2 volts and 10 - 20 ma through the LED as a reference point for one end of the meter circuit.

Carrier meter current is in parallel with R548 a 27 ohm resistor in the cathode of V506A a 5814. Cathode current is under 22 Ma. I am open to us measuring the current of V506A for various carrier meter readings.

Then we could do a new table of substitute meters, with the meter full scale current and the value of resistor we should use with that meter for R548. On the other end of the meter we would have a voltage set point source to be used as a reference voltage to R523 the carr meter adjust.

If we measure and publish the voltage and current of R548 with an open meter circuit, we could then pick substitute meters and calculate the value needed for R548 to fit with the new meter current.

Dave, I think any thing you do is good and useful to those that want to or need to go down this path. I like the stuff we are learning about the AGC circuits. I think this is one of the best threads going in some time.

Date: Tue, 28 Aug 2007 12:46:34 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Call for measurements - 100dB carrier reading

There are two problems with using a LED (or any semiconductor diode) as a reference regulator. One is the 25mV/C temperature coefficient of the forward-biased PN junction. This could be overcome by using an actual Voltage Reference; they are two- or three- terminal devices in the same package as a diode or transistor, and available down to at least 1.22V . I have one, which I was going to put into my Fluke 801 Differential Voltmeter to replace its dead Standard Cell, until the power transformer shorted; but that's another story.

The other is that a separate reference cripples a feature, namely, when you overload in MGC the meter reads upscale. This occurs because the gains and operating points are arranged such that the 6AK6 overloads first, and cuts off rather than saturating. Once the tube is cut off its current can't drop any further, but on the positive grid swing it stays in the linear region. The result is an increase in average cathode current, and since the meter reference is derived from it, the meter reads up. The designers specifically intended this, and that discourages me from overriding it.

Anyway, if you were trying to reduce the reference impedance as a way of retaining the normal full-scale reading, there are other ways to get it done. R549 affects it strongly; the same 12AU7 that reads 100dB with -12V AGC, reads 100 at -9 instead if you reduce R549 from 82K back to its R-390 value of 56K. This gives you a lot of

control over full-scale cal. I'm looking into this right now. I was just hoping I could get away without it, because it would then be so easy there'd be no excuse not to do it.

Note: V506A Ik idles at about 2.2mA not 22, bet that was a typo.

Gary Gitzen proposed exactly what you lay out below (changing R548 to enable substitute meters). Pete Williams tried it out with encouraging results, and I've been refining it, trying to hit the right values to work for the average receiver. It's taking me a long time because I'm slow and I don't get much time at it. My main contribution, however, is the realization that with any increase in R548, it becomes necessary to supplement the V504/V508 suppressor-grid diodes with a 1N914; otherwise you idle with several tenths of a volt of positive AGC and cook your 6DC6.

Date: Tue, 28 Aug 2007 20:19:27 -0400
From: "Jim M." <jmiller1706@cfl.rr.com>
Subject: Re: [R-390] Call for measurements - 100dB carrier reading

A big cause of AGC misbehavior is overzealous application of Deoxit or contact cleaner to switch wafers and tube sockets. That stuff is intended for low impedance circuits. It does conduct, although at high impedance, it still affects the very high impedance tube circuits, especially AGC.

The phenolic wafers and tube sockets, being pourous, absorb the stuff. Learned that the hard way on a KWM-2A and R-390a. The fix: Get some Big Bath moisture/oil displacement spray and clean the Deoxit or other spray out of the wafers and tube sockets.

Secondly, lubricating the antenna trim shaft can cause oils to be absorbed by the phenolic coupling in line with the shaft - it is supposed to insulate the antenna trim capacitor. It just so happens that this capacitor tuning shaft is smack dab on the AGC line in the RF module. Lubricating the antenna trim shaft again causes oils to be absorbed by the coupler, which has the effect of dragging down the AGC line. Live and learn.

Now for the meter zero, replace the carbon pot with a ten turn pot of the same value. I got one from Mouser for 10 bucks. Your meter will never drift again. Finally, bypass caps also tend to become leaky with age (the little .02 discs). Replace liberally. And resistors tend to drift upward in value - replace liberally if more than 10 percent high. Hope this helps. Jim N4BE

Date: Tue, 28 Aug 2007 20:10:51 -0700
From: "Leigh Sedgwick" <bipi@comcast.net>
Subject: Re: [R-390] Call for measurements - 100dB carrier reading

I disagree with one earlier comment kinda ripping this AGC discussion. I find this much more interesting than many of the topics that appear through the R390 threads....however,

I do have a rather simplifying question: Why not just use a 10-turn precision pot to solve the carrier meter zero issue? I made that change and it is now easy has heck to zero and the adjustment has not moved since. Keep up the great tech discussions...I learn a lot from them all!

Date: Wed, 29 Aug 2007 08:37:36 +0100
From: "Graham Baxter" <graham@delphe.co.uk>
Subject: Re: [R-390] Call for measurements - 100dB carrier reading

I have certainly learnt something. I had not recognised the very neat use of the suppressor grids as AGC clamp diodes.

Date: Wed, 29 Aug 2007 09:10:46 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Call for measurements - 100dB carrier reading

I may have mentioned this before, but the 100-ohm pot can also be replaced with a 20-ohm pot and discard the parallel resistance originally used with the 100-ohm pot. I used the 20-ohm pot (first image at the top left) on the following page:
<http://www.surplussales.com/Potentiometers/PBM-SlotAdj/PBM-SlotAdj-1.html>

(Ideally, the replacement pot should be 18 ohms, but I could not find one.) The shaft on this one has a smaller diameter than the original and I considered making a bushing to center it in the existing hole, but ended up just using sole 1/4" washers on both sides. It works well.

Date: Wed, 29 Aug 2007 12:38:53 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] re: Call for measurements - 100dB carrier reading

There were several responses advocating a 10-turn or low-ohm 1-turn pot. These can relieve the symptom (but see the quote below from the Cost Reduction Report), and as such will be fine for most of those who find the stockpot annoying.

A carbon potentiometer is used in the carrier level meter adjustment circuit. It offers less erratic operation and smoother control than the wire wound control.

- Cost Reduction Report, section 4.3.3

This quote suggests that the wirewound pot used in the R-390 had visible jumps as the slider contacted successive turns of wire. I have never seen an R-390 pot, so I can't comment, but I suspect this was a rationalization; cost was the primary motive.

One person recommended a 20-ohm pot from Surplus Sales of Nebraska. He feels that 18 ohms is the ideal value. I disagree, 8 is ideal. The nominal reference voltage, dictated by V506A's saturated plate current, is about 60mV. If the tube had infinite permeance, the current would be (205/82) or 2.5mA, which would develop 67.5mV across R548. The reference voltage is V504's cathode current through

R523. The manual obliquely says it is 13mA. I measured 10 to 12. Therefore, the worst-case maximum value of R523 is 67.5/10 or about 7 ohms. I found a 10-ohm pot at SSN, part number 140-6233. It's \$1.50. (You'll probably want to convert it to screwdriver-adjust by grinding a slot in the end of the shaft.) With this pot the adjustment range will be 45-65%. Assuming it uses fine wire, it's the best cheap palliative around.

I know I'm in the minority: I find the pot-replacement tactic profoundly unsatisfying. It's so... brute-force. There is a smart way to fix it too. Never mind that it's 55 years late, it's how they should have done it. Now that satisfies!

* * *

Graham had a lightbulb moment about the suppressor grids. Their use as diode clamps is mentioned briefly in the TM11-856A manual and maybe others. It seems like a weak argument to me. They aren't very good clamps. Turn down the RF gain (so the gain-controlled tubes don't become clamps themselves), pull out V506, and see what the AGC line does. On my set, it goes a couple of volts positive. That's all the suppressor grids can manage. V506's control grid is the real clamp.

A big thanks to Jim Miller N4BE for the reminder about DeOxit conductivity and his recommendation for a remediative treatment. I presume that Graham is already satisfied that his AGC line isn't leaking to ground. Mine isn't, I have more than usual. Regards, Dave Wise

Date: Wed, 29 Aug 2007 16:00:31 -0400
From: Barry <n4buq@knology.net>
Subject: RE: [R-390] re: Call for measurements - 100dB carrier reading

>One person recommended a 20-ohm pot from
>Surplus Sales of Nebraska. He feels that 18
>ohms is the ideal value. I disagree, 8 is ideal.

I was going on the fact that the original 100-ohm pot has a 22-ohm resistor in parallel with it resulting in an 18-ohm variable resistance.

Date: Wed, 29 Aug 2007 13:16:57 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] re: Call for measurements - 100dB carrier reading

Oh, that. I am convinced that R537 was the work of a naive junior engineer, to make a 100-ohm pot look like a 15-ohm pot. (My position is weakened, however, by the fact that he used 22 not 18.) And it does - as long as R523 is full CW. I sense a deep wrongness there. I won't repeat the computations I posted earlier, but the upshot is that the smallest value R523 ever needs to be set to is about 4 ohms and the largest, about 7. 10 is available cheap, but if you could find a 3 and put it in series with a 3.9 fixed, it would be as good as you can get.

Date: Wed, 29 Aug 2007 18:18:41 -0400
From: "Jim M." <jmiller1706@cfl.rr.com>
Subject: Re: [R-390] re: Call for measurements - 100dB carrier reading

I have used the Vishay/Spectrol 10-turn pot available from Mouser. This is the one I recall using (it's been a few years): Data sheet: <http://www.mouser.com/catalog/628/548.PDF>

Mouser part number for pot: 59453411101

The 10 turn pot will give much better zero adjustment and won't drift like a single turn pot. It's just small enough to fit under the bracket on the IF module. The wire wound pot described in the cost reduction report is probably a single turn, not a precision 10 turn.

Date: Wed, 29 Aug 2007 19:12:52 -0400

From: Bob Camp <ham@cq.nu>

Subject: Re: [R-390] re: Call for measurements - 100dB carrier reading

I suspect that the real answer is a bit more simple. Low resistance pots once had a reputation as being "low reliability" parts. Many places put them on a "do not use" list or made them difficult to use (lots of paperwork). Even in the early 1980's this was still true at Collins. My guess is that the carrier meter adjust was designed to "get around" those regulations.

Date: Wed, 29 Aug 2007 22:13:50 -0700 (PDT)

From: Perry Sandeen <sandeenpa@yahoo.com>

Subject: [R-390] re: Call for measurements - 100dB carrier reading

Over the years the 100 ohm pot was replaced 10 turn pots but still using a 2 watt unit. IIRC, Chuck Felton in his ER article on R390 upgrades shunted the pot with a low value 1/2 watt resistor. The question becomes: Could one use one of the multi-turn cermet type pots instead? They are cheap and plentiful. Multi-turn 2W pots are in the \$20 range now. I do concede the point that is won't look "original". Had anyone tried this?

Date: Thu, 30 Aug 2007 07:41:10 -0400

From: Bob Camp <ham@cq.nu>

Subject: Re: [R-390] re: Call for measurements - 100dB carrier reading

Just about *any* pot will work just fine. Another approach is to put a very low value pot in series with a fixed resistor. There's not a lot of power involved here. The only risk is that if the circuit opens up you may lose the meter.

Date: Thu, 30 Aug 2007 09:38:59 -0400

From: Barry <n4buq@knology.net>

Subject: Re: [R-390] re: Call for measurements - 100dB carrier reading

I think that's true. Theoretically you could use any value pot that covers the range needed to zero the meter. The problem would be that a very high-value pot (e.g. 1Meg., etc.) would have such a small area that covers the appropriate range that it would be nearly impossible to zero the meter. Also, a 1Meg pot probably doesn't have the low-end resistance range needed, but I'm talking about a theoretical pot

here. According to David, the range needed is about 4 to 7 ohms. A 3-ohm pot in series with an appropriate resistor would probably yield the best range to allow a single-turn pot zero the meter the easiest. Just my \$0.02. As I said, my 20-ohm, single-turn pot works well enough. Getting an exact (EXACT) zero is a bit tricky, but given that the meter is not a high-precision device to start with, it really doesn't matter that much.

Date: Thu, 30 Aug 2007 10:05:17 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] re: Call for measurements - 100dB carrier reading

>Low resistance pots once had a reputation as being "low reliability" <snip>

Thanks, Bob Camp, for your cogent bit of history. That's a compelling reason for them to go carbon. It's still a sloppy, naive implementation. I've figured out how they should have done it; that was my "simple mod" from a few posts ago. But to preserve the original full-scale reading requires we change R549. The next 20% value, 68K, overshoots the mark, so I'm looking for an acceptable combination of R537 and R549. I regret having to do this, because originally I thought we wouldn't have to remove the IF deck. That would have been irresistible. Bob brings up a point that had not occurred to me. In any circuit variant that does not shunt the pot with a fixed resistor, if the pot goes open, the entire V504 cathode current, around 12mA, goes through the meter, subjecting it to more than 10x overcurrent. Unfortunately, it's not possible to protect against this with the stock meter, because the voltage during the fault condition is well below any semiconductor diode turnon. So I guess the message is, don't ditch R537.

If you change R523 to 10 ohms, the original 22-ohm R537 will limit a fault to 3x, which the unusually large wire in the 17-ohm* stock meter should withstand, while reducing the worst-case available reference voltage from 100mV to 69mV which is still plenty.

* In the past I have said it was 18. I actually got around to measuring mine the other day, and it's 17.0. Sorry!

Barry N4BUQ mentions that his 20-ohm pot is "a bit tricky". Is that because of the turn-to-turn jumps? I always thought that was the real reason Collins went carbon, but not having played with an R-390 I have no justification for this. I don't know the wire size in Barry's pot or the 10-ohmer I found. As Barry says, we shouldn't get uptight over it. The zero is not exact; it drifts with line voltage and shack temperature, probably more than one wire's worth.

Would anybody with an R-390 care to comment?

Date: Thu, 30 Aug 2007 10:23:13 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] re: Call for measurements - 100dB carrier reading

Bob Camp already asserted that wattage was not an issue. I'll fill in the detail.

13mA * 67.5mV is less than 1mW. Going beyond worst-case, $13\text{mA}^2 * 100 \text{ ohms}$ is still only 17mW. Unless you were being deliberately perverse or have access to nanotechnology, you couldn't make a pot that can't take this. They picked a big one so techs wouldn't need a magnifying glass, that's all.

A 10-turn cermet would be fine electrically, but aren't they pcb-mount trimmers or something? There would be mechanical challenges and it would look odd. Also, a 100-ohm 10-turn is no better than a 10-ohm 1-turn.

I haven't read Chuck's ER article. If he was just changing R537, he was perpetuating the same old foolishness. The lower the shunt, the more likely that tube variations will tip you past the point where zero is not achievable. Lame! That's what drove me to look for something better.

Date: Thu, 30 Aug 2007 17:27:18 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] Re: Call for measurements - 100dB carrier reading

>I.....shunted the pot with a low value 1/2 watt >resistor.....

I did that using a 10 ohm 1/4 watt resistor and it works well.

>The question becomes: Could one use one of the multi-turn cermet type pots
>instead? They are cheap and plentiful. <snip>

The resistor in question won't dissipate anything near 2w. The actual dissipation would be a fraction of a milliwatt

>I do concede the point that is won't look "original".

Perry, you needn't concede anything. You have done us the service of compilation of a reference of postings from this forum, and of showing us solid state replacements for our beloved beam power tubes. Those who want original appearance will find an original-looking part or will use Dave Wise's clever modification.

Date: Thu, 30 Aug 2007 17:41:29 -0400
From: "Jim M." <jmiller1706@cfl.rr.com>
Subject: Re: [R-390] re: Call for measurements - 100dB carrier reading

>Also, a 100-ohm 10-turn is no better than a 10-ohm 1-turn.???

A 10 turn pot (such as the one I identified in previous email) will allow much finer adjustment of zero, and I believe would be more stable. I have used that replacement in several 390a's now and the meter zero is always dead on zero regardless, once I set it.

The 10-turn pot provides good vernier control as compared to a single turn. It's wattage is more than adequate. And it mounts easily. And it is sealed. And the

shunt resistor stays across it. AND THE METER NEVER DRIFTS. Me thinks you guys are making the problem much harder than it needs to be in terms of the meter zero adjustment. Not to criticize, but I think this subject has turned into a "mental candy bar" as they say in engineering, sometimes called "analysis paralysis."

Date: Thu, 30 Aug 2007 21:54:53 +0000
From: bipi@comcast.net
Subject: Re: [R-390] re: Call for measurements - 100dB carrier reading

That is my exact experience as well...the 10-turn precision pot was easy to adjust to zero and it has never moved since I made the modification. It was so good that I put one in my 51J4 with identical results. I also have one (of a different value) to put in a 51S1 when I get around to it. All that being said, I have enjoyed the technical discussions.

Date: Thu, 30 Aug 2007 15:18:53 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] re: Call for measurements - 100dB carrier reading

A 10 ohm 1-turn pot is 10 ohms per turn.
A 100-ohm 10-turn pot is 10 ohms per turn.

Okay, it's not "no better", but it's not 10 times better. If the 1-turn is 270 degrees, the 10-turn is only 33% better. It spends its life in the bottom turn, the other nine might as well be fixed. If you've tried both and seen a drastic difference, it must be attributed to the wire size and build quality, not the number of turns. I started this discussion not to supplant the time-honored ten-turn pot (I already conceded that it relieves the symptom), but to get into the design problem that makes it necessary. It's like a crooked wall with a jack bracing it. I'd like to know how it could have been built straight in the first place.

Date: Fri, 12 Oct 2007 23:21:15 -0400
From: Scott Bauer <odyslim@comcast.net>
Subject: [R-390] r390 carrier pot failiure

The carrier pot wiper fell out of my R-390 and I have been having trouble locating a new 16 ohm pot. I put in a 100 ohm 10 turn pot and then zero'd the meter. I then removed the pot and ohmed it out. It measured 8 ohms. I had a 7.5 ohm resistor in my junk box so, what the hell. I soldered it up and my meter sits exactly on zero when I turn the RF gain all the way back. I am thrilled and plan to keep it in place. I may put the pot in just for looks. Nobody will ever know. So there is my 16 cent science project for the day. I can now use my 390 without the needle pegged against the 100 stop. AES used to sell a 16 ohm pot but no longer stocks them. Fair stocks them but they are used. Who knows how long it will last.

Date: Sat, 13 Oct 2007 09:18:33 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] r390 carrier pot failiure

That fixed resistor will be fine until a couple of tubes age or get replaced. Then you will be stuck with a not-quite-zero and no tweak. There are two or three different low-ohm pots available cheap from Fair Radio that are appropriate for the R-390(*). Check their website. Exact model numbers are in the archive, I posted on this about a month ago. It doesn't need to be an exact replacement in this particular application, anything from about 10 to 20 is fine. (Above that will work too, but the adjustment gets progressively more finicky as you go up.) It's also possible to modify the circuit so that a low-ohm pot is not necessary, but the final writeups aren't out yet.

Date: Thu, 15 Nov 2007 15:25:54 -0600
From: "Bill & Becky Marvin" <wmarvin@hickorytech.net>
Subject: [R-390] A Few R390A Issues

Hello The restoring of my R390A nears completion I have a few issues that remain:
<snip>

#2 What are the wire colors that are attached to the Audio Level Meter?
Left Terminal Red/Wht Right Terminal ???? as viewed front panel.

Date: Thu, 15 Nov 2007 15:26:35 -0700
From: "DW Holtman" <tubestuff@comcast.net>
Subject: Re: [R-390] A Few R390A Issues

<snip> Looking down at the radio from the front, the left side (outside of the radio) there is one wire, White with a Red stripe. . The other terminal has two wires the same color, White with Orange and Black stripes.

Date: Wed, 16 Jan 2008 17:02:15 -1000
From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: [R-390] 390 meters

I've put together a handful of matching meters for the R390/R390A. These are NOT originals, but if you want to fill in those empty front panel holes with working meters, here's your chance. Everything (I think) about them is explained on my website at:

<http://www.qsl.net/kh6grt/page4/R390meters/meters.htm>

I'm asking \$55 for the two of them. Shipping is included to any US addresses. I prefer Paypal but will also accept a postal money order; personal checks and you'll have to wait 10 days for bank clearance before I'll ship. Any questions or interest contact me off-list. I only read my email once a day so don't expect a lightning quick reply. I'll try first come, first serve, but if the response is overwhelming, I might go to a lottery.

Date: Thu, 17 Jan 2008 17:02:31 -1000
From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: RE: [R-390] 390 meters

These are modified meters for immediate use.

Date: Tue, 18 Mar 2008 08:10:53 -0500
From: wf2u@ws19ops.com
Subject: Re: [R-390] fwd: bunches of R-390A's,etc for sale

Sure you can get back across the border with the radios as long as you don't hide alcohol, tobacco, firearms, drugs and similar "commodities" in them.... ;-) I brought back from Canada military surplus radios a number of times. Among them was that huge 6 ft tall ex-Canadian Navy 500 W Canadian Marconi transmitter. Not that it was ever asked of me, but I carried a copy of my amateur licence with me, just in case. I even hear stories that some people encounter customs agents who are hams themselves...73, Meir WF2U Landrum, SC

Date: Tue, 18 Mar 2008 08:22:40 -0500
From: Gord Hayward <ghayward@uoguelph.ca>
Subject: [R-390] Bunches of Radios and the Border

Just make sure the real meters aren't in there. Dope sniffing rhinos are nothing if you trip the radiation sensors.

Date: Tue, 18 Mar 2008 09:31:18 -0400
From: "Gregory W. Moore" <gwmoore@moorefelines.com>
Subject: Re: [R-390] Bunches of Radios and the Border

I am not at all sure that the meters would trip the radiation sensors. Aren't the meters Radium?? if that is true, then we are talking alpha, and the glass faces will stop all traces. Correct me if I'm not right here, but all the hoopla about the "radioactive meters" is 99% Gov't BS, and the other 1% about the fear of the glass getting broken and allowing that miniscule amount of radium to escape --hi--- I wouldn't eat them, and would wash my hands if I came across a busted meter, but that's all the precautions I would take...

Date: Tue, 18 Mar 2008 10:50:56 -0400
From: Jon Schlegel <ews265@rochester.rr.com>
Subject: Re: [R-390] Bunches of Radios and the Border

According to <http://en.wikipedia.org/wiki/Radium>, Radium is an alpha, beta and gamma emitter. I'd guess that the gamma radiation would have the energy to go through almost anything except perhaps a block of lead. It's likely then that the gamma radiation would at least reach the detectors. I'd guess that whether or not the sum total of the level (power) of gamma radiation would be enough to trip the detectors would be the issue. <snip>

Date: Tue, 18 Mar 2008 09:51:33 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] Bunches of Radios and the Border

No, it isn't all stopped by the glass. You can get Geiger clicks a foot away with a

sensitive counter. Maybe a few millirem, IIRC. The military removed the meters because they were a hazard with a hundred radios on a pallet, or more in a warehouse.

Date: Sun, 23 Mar 2008 09:10:37 -0500
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] Meter Gaskets \$1 each

Dave I have close to 1000 new rubber gaskets that I had made a couple of years ago. a buck apiece plus mailing .50 for 2 or 4. Hank KN6DI

Date: Sun, 23 Mar 2008 09:33:11 -0500
From: "Dave Merrill" <r390a.urr@gmail.com>
Subject: Re: [R-390] Meter Gaskets \$1 each

Great! A second source - thanks Hank

Date: Sun, 13 Apr 2008 20:32:38 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Receiver restoration

There are meters available that have the correct size and form fit. You can replace the meter face plate with a printed copy and a glue stick. You can rework the resistor bridge resistors to allow the new meter to read close to good line level values.

For the carrier meter an IC OP AMP is used to scale the meter voltage from the tube circuit to drive the replacement meter to proper scale value. It takes some math and basic knowledge to get it done. Exact replacement old but working meters cost. It becomes a quest. Happy to hear you have the receiver working.

Fair Radio was selling a meter with a bridge as a kit that makes a SWR meter. The meter is the same size and face plate as the R390 meters.

I ordered two kits to get the meters to install into a Blue stripper I brought from Fair Radio. You mite look and see if these kits are still available for the meters.

I have not installed mine and worked through the modifications needed to get them working. My next project when I get the house remodeled.

Date: Thu, 24 Apr 2008 14:47:36 -0500
From: "Phil M." <pmills7@comcast.net>
Subject: [R-390] Some R-390 questions...please help if you can.

First, this is really a Motorla (non-A) from 1952. The meters have what looks like to be an ink stamp on the lower right corner of the glass that consists of three concentric circles with a 14 in the center. The outermost circle is about 1/2 inch in diameter. What does this mean? <snip>

Date: Thu, 24 Apr 2008 15:59:04 -0400

From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] Some R-390 questions...please help if you can.

> .. The meters have what looks like to be an ink stamp<snip>

Just a guess on the meter stamps: they may be inspection stamps. <snip>

Date: Thu, 11 Sep 2008 20:16:29 -0500
From: "Barry" <n4buq@knology.net>
Subject: [R-390] OT: Meter Internal Resistance

I have a Triplet panel meter that was originally shunted to 1A DC full scale. I want to use this as a voltmeter so am in the process of analyzing the meter movement. I have measured the full scale deflection to be 8 mA. I thought this was a rather odd reading, but it agrees with both my analog meter and DMM. With them both in series, they both show 8 mA so I'm pretty sure this is correct. What I'm wondering about is the internal resistance. I connected a pot across the meter and adjusted it so the meter under test read 1/2 scale. The pot measures 8 ohms. Again, this seems a rather odd value.

I then connected the DMM in DCV mode across the meter and set the meter under test to full scale deflection and measured the voltage drop across it. It measures 55 mV. 55 mV divided by 8 mA yields 7 ohms making it pretty close to agreeing with the 8 ohms I was reading on the parallel pot. Do these values seem "normal"? I was thinking these little meters would typically have a 1 mA FS and something on the order of 100 ohms or more. Just wondering if I might be way off and not realizing some doofus mistake (which I am somewhat prone to making).

Date: Fri, 12 Sep 2008 09:00:13 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] OT: Meter Internal Resistance

Sometimes it's the little things that are so much fun.

Using 8 mA as Full Scale, I wanted to make the meter a 10 VDC Full Scale volt meter. A quick calculation showed the resistance should be around 1242 ohms. Scrounging through my stuff, I came up with a set of resistors that came to around 1260 ohms. I hooked that in series with the meter and cranked the power supply up to 10 V. Nearly perfect. I put a larger resistor across one of the larger resistors in the chain (dropping the overall resistance by just a bit) and the meter started tracking just as it should.

I don't know why, but something's rewarding about doing something so simple like this. I've had these meters sitting on the shelf and wanted to use them at some point. They were both originally 1 ADC and I want to make a 9VDC power supply that can supply at least 1 A so using these meters will give me a nice matching set of meters - provided I can get a new faceplate for the volt meter.

If it comes to it, I can print a new meter face, but I have a line on a possible source

for a junk meter that matches with the right lettering. If so, I'm set.

Date: Mon, 15 Dec 2008 10:55:47 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] R-390A Carrier Meter Full Scale

>I turned on the R-390A and it makes noise. The RF and AF pots seem to work,
>but the Carrier Meter is hard over to the right. Before I start hitting it with the >silver
hammer, I should ask if there are common faults I should first look for.

There is a carrier adjustment pot on the IF module. With no antenna connected, try
turning this pot and hopefully you can get the meter to read zero with no antenna
connected. The correct procedure is in the Y2K manual.

Date: Sat, 10 Jan 2009 05:13:02 +0000
From: odyslim@comcast.net
Subject: [R-390] meter to trade

I have an EAC radio that came with one white faced VU meter and the carrier meter
is black. They are slightly different than the normal meter. I believe they were the
replacements for the originals. They have an adjusting screw in the bottom center. I
would like to trade the black carrier meter for a white one. does anybody have one?
As I noted, these look like they were designed for the R-390xx, they just look a little
modern in appearance.

Date: Sat, 10 Jan 2009 13:26:43 -0500
From: Gene Beckwith <W8KXR@neo.rr.com>
Subject: Re: [R-390] meter to trade

The white faced meters did show up in later ships stores as official replacements..
have a Navy version that has a white left hand meter...I know the origin to be
authentic....

Date: Sat, 10 Jan 2009 15:48:59 -0600
From: "keller family" <kellerfamily01@charter.net>
Subject: Re: [R-390] R-390 meter to trade

The white faced Vu meters were definitely used by the military on R-390A radios. I
have seen on intercept radios being operated in real time that had white faced
meters, so having a white faced meter does not make an R-390A an unauthentic
radio. I think I have a couple of brand new white faces in my spare parts bin.

Date: Sun, 22 Mar 2009 11:14:15 -0500
From: "Clarence Lozano" <jeeper@netins.net>
Subject: [R-390] Meters

Hello to every one. Is there a safe way to fix meters that do not return to zero

Date: Sun, 22 Mar 2009 13:54:31 -0500

From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] Meters

I just finished working on a Triplet panel meter (220-G series) that was sticking at around the 2/3 scale position. I removed the pivots and cleaned them, but that wasn't the problem. It turned out to be a tiny bit of magnetic trash that had gotten in the space between the barrel and magnet. It was pretty difficult to clean properly and I didn't get it all out, but I got enough of it so that it doesn't stick anymore. I used a small strip of paper and passed it in the air-gap several times before I could get it all cleaned out. It doesn't take much to disrupt the operation of the meter and you pretty much have to look in the gap with an eye-loupe to see it well. Trash in that location might be what's preventing your meter from zeroing properly, but there's probably a host of other things that might account for it as well. If yours is one of the "glow-in-the-dark" variety, then I'd not recommend any cleaning like this or even disassembling it at all. You'd likely dislodge trace amounts of radium-covered dust, etc., and you wouldn't want to ingest any of that.

Date: Sun, 22 Mar 2009 16:02:58 -0400
From: K2CBY <k2cby@optonline.net>
Subject: [R-390] Meters

Next time, instead of paper, use a piece of Scotch tape folded sticky side out.

Miles Anderson, K2CBY
16 Round Pond Lane
Sag Harbor, NY 11963

Date: Sun, 22 Mar 2009 22:01:41 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] Meters

Try masking tape. It "gloms" onto the dirt better.

Date: Sun, 22 Mar 2009 22:52:47 EDT
From: JRFKE5RI@aol.com
Subject: [R-390] R390A meters

Here is a suggestion for meter repair tools. They are cheap, easy to make and they work. For untangling and repairing hair springs:

Take a sewing needle and using a cutoff wheel, like a Dremel tool, cut off the very tip of the eye so that the end is open. Now cut the end off of a miniature, wood handled paint brush - the kind that is used for painting models. Press the sharp end of the modified needle into the handle. Now you have a tiny tool that is perfect for working with the hair spring.

For maneuvering pivots, etc, make a similar tool with a straight pin. Take the little ball of the end of the pin. Push that end, the dull end, into another wooden paint

brush handle. Now you have a tiny, precision pointed instrument. When disassembling meter movements, cleanliness is absolutely essential. I put the parts on piece of white paper. Most damaging are tiny ferrous metal fragments. As you know, they WILL end up in the magnetic gap! As previously stated by others, scotch tape is the cleaning tool of choice. Good luck. John Felton

Date: Thu, 25 Jun 2009 17:06:00 EDT
From: TVComlGuy@aol.com
Subject: [Collins] Meter repair

Good afternoon to the group, I have a 51S-1 that the meter sticks about 3/4 of the way up. I took it to a local watchmaker and he couldn't fix it but said that everything looked OK and nothing was broken. Is there anyone out there who does meter repair?

Date: Thu, 25 Jun 2009 20:09:47 -0400 (EDT)
From: Bill Stewart <cwopr@embarqmail.com>
Subject: Re: [Collins] Meter repair

There was an article in the latest Electric Radio about 'exercising' or 'dithering' meter movements that have sticky places. Don't have the mag. in front of me, so can't give any specifics. But it might give you a possible way to get it unstuck before you have to go into it again.

Date: Thu, 25 Jun 2009 17:55:07 -0600
From: "Dr. Gerald N. Johnson" <geraldj@weather.net>
Subject: Re: [Collins] Meter repair

If there's nothing around the pointer dragging, its probably picked up a bit of steel held in the air gap by the magnet. Sometimes those can be cleared up with masking tape folded sticky side out and slide into the gap, these days double faced tape might work. The last meters I got into didn't survive my touch. In the past, places that repair and calibrate test equipment, like Scherrer Instruments on Manchester in St. Louis had men who could take meter movements apart and fix them. But I've not tried to get that done in a long time.

--

73, Jerry, K0CQ, Technical Advisor to the CRA

Date: Thu, 25 Jun 2009 20:23:21 -0500
From: GDM <1gdm3@charter.net>
Subject: Re: [Collins] Meter repair

Contact Eldad at Eldad@HVC.RR.com

First turn around, good price and fixed right. He did some HP test gear meters for me and I was quite satisfied.

Date: Thu, 25 Jun 2009 20:49:03 -0500
From: Robert Nickels <ranickel@comcast.net>

Subject: Re: [Collins] Meter repair

> Sometimes those can be cleared up with masking tape folded sticky side out
>and slide into the gap, these days double faced tape might work.

I've fixed several using a thin flat toothpick with a piece of double-sided tape attached to probe into the air gap, where there is inevitably a tiny piece of debris (mostly likely magnetic) that is interfering with the free movement of the meter armature. An old meter repairman taught me the secret of doing this work is to combine maximum light and magnification with minimal caffeine!

Date: Thu, 25 Jun 2009 20:17:15 -0600
From: "Dr. Gerald N. Johnson" <geraldj@weather.net>
Subject: Re: [Collins] Meter repair

And only on a day when you feel steady. The experienced men I've known who were good inside meters had their good days and their bad days and they knew when it wasn't profitable to touch the works of a meter.

Point is, the watchmaker could have steadiness to apply the same technique of the double stick tape, because you can't go in the gap with a magnetic tool and keep it controlled, wood and cellophane with stickum on it (like double-faced tape) are about the only tools that will be successful in the gap.

With a few inches of fresh tape, it may not be necessary to see the bit of metal, just sweep the entire air gap inside and outside the coil. And since the magnet is strong, you won't make progress if there is any magnetic debris on the bench within several feet of the opened meter.

Date: Fri, 26 Jun 2009 02:24:00 +0000
From: Telegrapher@att.net
Subject: Re: [Collins] Meter repair

Might work with a regular meter but when you've got one in a sealed case like the Collins 51J/R-388 types, how do you even get into it?

Date: Thu, 25 Jun 2009 20:52:03 -0600
From: "Dr. Gerald N. Johnson" <geraldj@weather.net>
Subject: Re: [Collins] Meter repair

You don't expect grunge like metal fillings to get into the sealed meter. One of the benefits of sealing.

Date: Thu, 25 Jun 2009 19:38:47 -1000
From: "Raymond Cote" <rjcote@hawaii.rr.com>
Subject: Re: [Collins] Meter repair

FWIW, When I had a problem with my 51S1 and 74A4 meters, I finally got some chemical at the University here where I worked and cleaned the glass with it. It took

out the static electricity from the glass and the meters worked fine after that. YMMV Worked for me.

Date: Fri, 26 Jun 2009 12:53:09 -0600
From: "Dr. Gerald N. Johnson" <geraldj@weather.net>
Subject: Re: [Collins] Meter repair

Static guard spray or undiluted dish washing detergent is good at dissipating the static charges on a meter glass or plastic window. Don't polish it later, or the static charges will build up again.

Date: Fri, 26 Jun 2009 21:12:56 -0500
From: "Bob McGraw - K4TAX" <RMcGraw@Blomand.net>
Subject: Re: [Collins] Meter repair

For plastic meter lens and to some extent glass ones too, use any of the common fabric softener sheets that's used in the clothes dryer. Just wipe the face and the static is gone.

Date: Sat, 5 Sep 2009 19:09:28 -0500
From: <ka9egw@britewerkz.com>
Subject: [R-390] Meters

I have obtained some NOS 1mA FS meters in the correct form factor for the 390 panel meters. What do I have to do to use them in my meterless Collins-built 390A? I've heard it's not as simple as just installing them and tweaking a couple pots...

Date: Sat, 5 Sep 2009 21:33:01 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] Meters

Here is a brief summary of your situation:

- Good scans of the R-390A meter faces are available, and most meters of the sort can be opened up to put in a new scale. You may have to make special tool if the meters you have are put together with the ring type fastener instead of small screws.
- ONLY the line level meter is a candidate for replacement with the meters you have, UNLESS you make a most-likely solid state amplifier for the RF level meter. The line level meter is a VU meter, it runs on AC and your meters can be made to run well with a little rectifier and most likely a dropping resistor or two.
- The RF level meter is both much more sensitive than the line level meter, AND it has a particular, odd, and unique internal resistance. All that combined makes it run correctly with the circuits in the radio. Building a solid state "signal conditioner" circuit is quite feasible. Someone must have done this already, and if so other guys on the list will no doubt offer further information. If nothing further shows up on the

list or in your mailbox, let me know. I no doubt have further information in the archives here (I do have the meter face graphic files.)

Date: Sat, 5 Sep 2009 21:34:31 -0500
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] Meters

<http://www.skirrow.org/Boatanchors/TechTalk2.pdf>

Date: Sat, 5 Sep 2009 23:16:33 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] Meters

Thanks to Barry for posting that link. That page mentions that the RF level meter is a one ma movement (I was mistaken), but points out that the internal resistance is not the same as other meters you are likely to find. Here are a couple of posts from much earlier that give more details:

> Date: Wed, 6 Jan 1999 20:20:56 EST
> From: DCrespy@aol.com
> Subject: [R-390] Meter Specs
> The Carrier meter is a 1 mA movement, but the key to getting it to work is the
> internal resistance.. From HSN, I've heard that the movement should be 17
> ohms. I have measured new and used ORIGINAL meters around 17 to 20 ohms.
> I have have good luck making 35 to 40 ohm meters work. I could not get the
> most common 100 ohm one to work well. The Line Level meter is a regular >AC
> Vu meter. >Harry KG5LO Saline MI

> -----
> Date: Wed, 06 Jan 1999 22:13:34 -0500
> From: Will Schendel <n8azw@megsinet.net>
> Subject: Re: [R-390] Meter Specs
> I just measured four ORIGINAL used Simpson carrier meters that seem
> to work well, they read 17.3 to 18.0 ohms resistance. Hope this helps to
> confirm the meter resistance question...

Date: Sun, 6 Sep 2009 21:04:21 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: [R-390] Fwd: R-390A replacement meters

Gary has some information to add to the discussion. The link below gets you to the archives of the list. Look for the topic he mentions.

> From: Gary Gitzen <ggitz2gx@redshift.com>
> Date: September 6, 2009 4:44:37 AM EDT
> To: k1lky@earthlink.net
> Subject: R-390A replacement meters
>
> Hi Roy,
>

Geiger counter (a new, sensitive one, not an ancient CD unit that's only capable of telling you that you're dead). The Simpson and International meters I have/had were radioactive.

Date: Fri, 11 Sep 2009 20:05:03 -0500
From: Mahlon Haunschild <mahlonhaunschild@cox.net>
Subject: Re: [R-390] meters arrived

Correction: the stuff on the glass is most likely ^{210}Pb , not ^{214}Pb or ^{214}Bi . But the decay of the latter two is where the beta particles come from.

Date: Sun, 13 Sep 2009 11:54:28 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] meters arrived

I thought all the R390 meters would make a counter tick even the phosphorescent (non-radioactive) replacement meters in a 390A. I thought it was this problem that caused all the meters to be pulled from the Julian Creek receivers. The "maintenance process" was so flawed that some clown declared all meters to be ticking and thus needing to be removed. Stop and think about what is happening in the phosphorescent process every time a photon jumps out of the paint and strikes you in the eye (or else where). You get an E field change, likely an M field change, and the Geiger counter goes tick. Counter ticks it must be radioactive.

Date: Sun, 13 Sep 2009 13:24:51 -0400
From: rbethman <rbethman@comcast.net>
Subject: [R-390] Radioactivity and meters

My use of GM equipment has been almost exclusively the Eberline series. There is a window on the bottom that the aluminum slide over and opens the mica window. Every so often this thread comes up. Do you remember the "glow in the dark" watches everyone wore during the '50s and into the '60s? The very same material was painted on the dial faces! How many have had issues? Yes, alpha particles decay into other particles. However, alpha particles cause the most damage if inhaled or ingested. The other particles do far less damage to tissues due to far less mass.

What no one discusses, and what really matters, is what is the disintegrations per minute? This allows one to then determine the actual activity. A GM will not do this. It is going to take a lab counter with a lead pig, and time.

Since the amount of material applied to the meter face is small, the overall activity should be pretty small. I've yet to hear of radio intercept operators having suffered ill effects over numerous years of operating these radios, AND the material being at a higher level of activity. The level of activity decreases over time. I believe that if someone had access to a lab with the appropriate equipment, we could get some "real" data that could shed light on the subject.

Otherwise people are getting concerned over something that isn't at a level to be

worried about. You'll get more radiation on a transoceanic or transcontinental flight.

Date: Sun, 13 Sep 2009 19:57:14 -0500
From: Mahlon Haunschild <mahlonhaunschild@cox.net>
Subject: Re: [R-390] meters arrived

The ones in my '68 EAC are not radioactive. Meter brand is unknown.

Date: Mon, 14 Sep 2009 09:43:11 -0400
From: Gord Hayward <ghayward@uoguelph.ca>
Subject: Re: [R-390] Radioactivity

Especially the November 2003 X20 flare. The dose estimate from that kind of event is 1 chest X-ray on the ground or 100 chest X-rays in a northern route flight from Europe. That night the ONLY station I heard on my 390 was Radio Havana. I'm not worried about the dials, but I think I'll hang one of my dosimeters by the set and wait a couple of years.

Date: Mon, 14 Sep 2009 23:29:17 -0500
From: Mahlon Haunschild <mahlonhaunschild@cox.net>
Subject: Re: [R-390] meters arrived

All of the R-390A meters I've handled most definitely are original. As I said earlier, an ordinary G-M counter doesn't count the alpha particles from the radium decay, but does count the beta particles and gamma rays from the decay products (polonium, lead, and bismuth). You could of course count the alpha particles from the radium decay if you had a counter with a suitable G-M tube (mica window) and removed the dial from the meter, but that's an academic exercise.

Date: Tue, 15 Sep 2009 01:18:09 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] [KA9EGW] s/n 4214

>> A number of people have advocated soap and water... <snip>

Some points here: The two most experienced Collins restorers I know use 50-50 409 and household ammonia with paint brushes and a squirt bottle, followed by lots of fresh water and then warmth to dry the radio. Same for the modules, inside and out. For the R-390's, remove all modules for cleaning separately, pull the slug racks and put tape over the slug holes. The meters and everything else is pretty waterproof. If your geartrain needs help, pull the RF deck, position it over a turkey roasting pan and squirt brake cleaner or diesel fuel or kerosene onto the gears. Then do the wash above. The Air Force prohibited Simple Green for use on aircraft because it caused corrosion of the aluminum parts. Many fellows report good results if the thing is washed very well afterwards. Of course the Air Force overhaul facilities have an approved aircraft cleaner that does not cause trouble, but we normal folks don't have access to that stuff. (I have a copy of the simple green notice from the air

maintenance newsletter if anyone needs to read it.) I strongly recommend use of Caig CaiLube (was MCL - Moving Contact Cleaner) on carbon pots, and De-Oxit on switches (applied VERY sparingly) and on all connectors.

> ... Make sure you keep it warm enough for long enough that you evaporate ALL the water hiding in crevices and inside IF cans and such like, but don't get it hot enough to melt anything.

A couple of reflector flood lamps aimed at the chassis, with a modest air flow from a fan will dry the thing out if you don't want to trust the kitchen oven on WARM.

Date: Tue, 15 Sep 2009 08:32:40 -0400
From: k2cby <k2cby@optonline.net>
Subject: [R-390] R-390A s/n4214 [8719-p-55] known issues

Loose wires: the wires may come from the antenna relay. Alternatively, they may come from the selenium rectifier just outboard of the antenna relay. This part is a definite "known issue" which goes west predictably in long-service R-390As.

Date: Wed, 23 Sep 2009 12:24:46 -0400
From: Roger Gibboni <rgibboni@dulye.com>
Subject: Re: [R-390] Meter Question

Gang---Does anyone know if there is a currently available meter that has the same form factor as the 390A meters? This is for a non-390A project but that meter format would be perfect. It doesn't need to have a scale like the 390 meters or the same movement---1 MA or so can be made to work. Just need to know if they make one like that and where I can get it---Roger WA3YTM

Date: Wed, 23 Sep 2009 14:20:53 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Meter Question

If you're talking about a NOS or used meter, yes.
Check out the DeJur meters here:
<http://www.leedsradio.com/parts-meters.html>

They're 100uA so if you need 1mA, then you might have to look elsewhere; however, I believe there are 1mA types as well. I see them quite often on eBay.

Date: Thu, 26 Nov 2009 20:11:20 -0500
From: frankshughes@aim.com
Subject: [R-390] R-390A dB meter as as "S" meter

I will soon embark on my first HAM communication! (goal=2010)
- license = General, KJ4OLL
- receiver = R-390A & Alpha-Delta DX-Ultra
- transmitter = Collins 32S-3

- still looking for a microphone, transmit antenna, SWR meter/tuner

I have been listening to the bands for almost a year to learn, and just realized that there is no meter to provide a signal report. 5/9 on an R-390A dB meter? Where is the "S" meter on this critter anyhow;) Is there any way to equate R-390A dB readings to numeric values on an S-Meter? I guess if the R-390A dB meter peaks over 50% and copy is clear to my ancient auditory ossicles, I'll just say 5/9, rather than try to explain that I like using boatanchors.....

Date: Thu, 26 Nov 2009 20:31:19 -0500
From: "Al Parker" <anchor@ec.rr.com>
Subject: Re: [R-390] R-390A dB meter as as "S" meter

That works for me, and has for yrs. Nobody complains. db over 9 is superfluous, and you can guesstimate if it's below 50%.

Date: Thu, 26 Nov 2009 19:37:56 -0600
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] R-390A dB meter as as "S" meter

On the 390A it's labeled "carrier level". I leave it to the better-informed on this list to equate values [and please copy me HI].. There's been a zillion threads about it on this reflector--check the archives.

Date: Thu, 26 Nov 2009 21:15:04 -0500 (EST)
From: JAMES BRANNIGAN <jbrannig@optonline.net>
Subject: Re: [R-390] R-390A dB meter as as "S" meter

The 75S-3B "S" meter is calibrated in db. and S-units. I use that as a rough gauge, but since I am about 300 miles from my radios it will be a few days before I can produce a chart. In any event it is not really important. Most signal reports are given by ear and the meter is used for comparisons.

Date: Fri, 27 Nov 2009 09:05:58 -0500
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] R-390A dB meter as as "S" meter

There is an official S-meter scale that you could calibrate your receiver to. S9 is defined as 50uV into 50 ohms.

But very often any absolute scale is meaningless. Summertime atmospheric noise on 80M where I live is regularly way above S9 using my full 80M dipole. What meaning does a "S9" report to someone mean when he's still less than the noise? And if I have a big antenna pointed right at someone and am getting S9+30, and the guy next door has a little 10 inch whip and is getting S3, by the official scale, yet we're both clearly hearing the guy way above the noise, what does that all mean?

In common use on the ham bands trading 599's with the DX is usually

meaningless, and anything reported below S9 is usually subjective relative to band noise. I know this breaks the official standard but it's life. You could spend your whole ham career trying to report S meter readings by the official standards but that's honestly not too fun.

Now, any S-meter does come in handy comparing two of your antennas, or helping another ham compare two of his antennas, for relative readings.

Date: Fri, 27 Nov 2009 09:53:04 -0500
From: Gord Hayward <ghayward@uoguelph.ca>
Subject: Re: [R-390] R-390A dB meter as as "S" meter

I've enjoyed it - calibrating S-meters has been one of the things I like to do. It is like the outside remote antenna tuner that I built for 80m. I can honestly claim SWR matches of 1.05:1. Not meaningful but lots of neat bragging rights. In the matter of '59' I remember getting into an AM pileup and after many tries getting the contact who then gave me a '59'. What can I say?

Date: Fri, 27 Nov 2009 10:10:51 -0500
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: Re: [R-390] R-390A dB meter as as "S" meter

How do you calibrate your S meter. I was trying to that on a 75S-3 and gave up other than to just set the IF gain to give a S9 reading when the meter on my HP-606B read 50 uV.

Since the 606B meter reading are accurate only when working into a 50 ohm load, what load is the input circuit of the receiver? Is it the same for all bands? If you use a 50 ohm terminator for the signal generator, do you put it at the signal generator end of the coax connector or at the receiver end.

What is the impedance at the end of the piece of coax that connects the receiver to the signal generator? Etc, etc.

Date: Fri, 27 Nov 2009 10:25:13 -0500
From: Gord Hayward <ghayward@uoguelph.ca>
Subject: Re: [R-390] R-390A dB meter as as "S" meter

I'm a bit of a heretic here. I set the signal generator to give me 0.05V (thats as low as it will go - its a Stanford synthesized unit) and use a pile of attenuators to get 50 uV into a 52 ohm terminated line. This goes to an LH0066 damn fast buffer so that there is no interaction between the input circuits and the attenuator chain. I use a few other voltages and attenuator settings to build a calibration curve. On one set (not a 390) I turned the meter face over and made my own scale. As near as I can tell from this procedure, the carrier level meter on my 390A reads exactly what it is supposed to. Of course the S meter calibration is only good at one frequency and gives the voltage at the antenna terminal of the receiver. Mismatches are not included in the calibration, so a bad signal report may be mostly my own fault.

Date: Fri, 27 Nov 2009 16:21:18 EST
From: DJED1@aol.com
Subject: Re: [R-390] R-390A dB meter as as "S" meter

If you look at the original Military tech manual, it has a curve of meter reading vs signal level. What the meter is supposed to read is dB relative to 1 microvolt, just as the meter on the SP-600 does. This means that 0 dB is 1 microvolt, and 40 dB is 100 microvolts. If you define 50 microvolts as S9, then 34 dB will be S9. This ignores the issues of a receiver with a non-50 ohm input impedance, but this error is small compared to the accuracy of the R-390A meter circuit, and entirely negligible compared to the average ham signal report. So for practical purposes, any reading approaching 40 can be considered over S9, and you can easily scale readings above S9. Unfortunately, there's no way to adjust the meter reading. I think the original specs for the meter were that the reading be within +/-10 dB. And I'm sure it hasn't improved with age. Ed

Date: Fri, 27 Nov 2009 18:33:24 EST
From: DJED1@aol.com
Subject: Re: [R-390] R-390A dB meter as as "S" meter

I'm referring to figure 41, p75 of TM 11-856A. The graph shows a linear plot starting at 20 dB=10 uv, and extending to 100 dB. If you extend the line through 0 dB, it passes through 1 uv. Perfectly reasonable, except my radio never followed the curve to within 20 dB, and I expect they were all the same. Mine was wildly optimistic, and that's what your NAVSHIPS reference says. So that's why I think the Fig 4 graph disappeared, never to be seen again. But based on the graph I think the Army would have liked the radio to satisfy that scale within some degree of accuracy. Having said that, I'll stand corrected that S9 should be closer to 50 dB. I've found the SP-600 meter to be pretty accurate at high signal levels, given that you're trying to read a scale where 1/16 inch = 20 dB.

Date: Fri, 04 Dec 2009 12:08:54 -0600
From: Frank Donnelly <goober@centurytel.net>
Subject: [R-390] Carrier meter Dead

I have a Dittmore-Friemuth R-390A, and the Carrier meter does not work. I can zero it with the carrier adjust. I tried replacing V-503 6BA6 3rd IF tube and V-504 6AK6 4th IF tube but still no good. Before I start digging any further I figured better to ask first. The R-390A has been recapped and aligned and then sent to Rick Mish for checkout and realignment. It works fine but no movement other than a slight tick when I sw. from MGC to AGC. If I tune in a strong AM carrier, no movement on meter. Any suggestions from the group would be appreciated.
Many thanks Frank KI0RQ

Date: Sat, 05 Dec 2009 16:50:21 -0600
From: Frank Donnelly <goober@centurytel.net>
Subject: Re: [R-390] Carrier Meter Dead:

Problem solved . While checking Z-503 for continuity, I checked V-508 AGC IF Amp "5749" and it was very weak. Replaced and Carrier Meter is working now.

Date: Fri, 25 Dec 2009 20:25:38 -0200
From: samuel rocha <battcharger@gmail.com>
Subject: [R-390] A R-390A carrier level defective

R-390A, Stewart Warner serial #4338 I had already made the R390A basic maintenance tips by Don Reaves,W5OR - Changed all the bad capacitors and weak tubes and I got the receiver working with a few problems, so I need help from the Group. I also made the R390-A Carrier Meter Zero Adjust Modification, but the carrier level meter only moves slightly with a very strong signal.

Date: Sat, 26 Dec 2009 13:12:01 EST
From: flowertime01@wmconnect.com
Subject: Re: [R-390] A R-390A carrier level defective

The next step is to haul out the basic meter testing procedures (copy off the web from some place) and test the meter. These meters do go bad. Mostly a bit of stuff gets wedged in the meter movement and causes the meter to hang up. You can clean the meters up and save them. Next problem is stuff sets up in the meter jewels. This too can be cleaned up. This work is out there at the watch maker level. The meters do come apart and can be cleaned. Do test the meter to determine if the problem is internal or external. If internal, you may just want to let the meter set as is until you get every thing else done. You may want to clean and inspect all the subassembly plugs and pins between the IF deck and the meter. A dirty pin or plug can cause losses and still allow you to zero the meter.

Date: Tue, 24 Aug 2010 08:20:44 -0500
From: <ka9egw@britewerkz.com>
Subject: [R-390] Meter wiring

Finally starting a decades-delayed restoration. There are 3 wires going towards the carrier level meter in my R-390A. One is broken off the ring terminal. I'm assuming one ring terminal had 2 wires and the other had one. Can someone take a glance and tell me which two should be paired and which is the single one?

From: Ron and Donna [mailto:rdhdmh@embarqmail.com]
Sent: Tuesday, August 24, 2010 10:44 AM
To: ka9egw@britewerkz.com
Subject: Re: [R-390] Meter wiring

When I read your posting I took the top cover off of my R-390A and looked. When standing in front of the unit the carrier level meter is on the right and mine only has 2 wires going to it. One wire is white with a orange and a black tracer. This wire is connected to the right side terminal of the meter. The terminal on the left has a white wire with a orange and a brown tracer connected to it. The bottom line is that mine only has 2 wires connected to it. However, the line level meter has 3 wires connected to it. Two wires go to the terminal on the right. Both are white with

orange and black tracers. The terminal on the left has a white wire with a red tracer. I hope this helps. I can take photos if it would help you. 73's. Ron, KA8UDS

Date: Tue, 24 Aug 2010 11:14:15 -0500
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] Meter wiring

Can you tell I bought this unit without meters? HI HI. Minor brain-ial QSB here. Yep, it's the line level meter we're talking about, and this tells me what I need to know.

Date: Tue, 24 Aug 2010 16:33:24 -0500
From: <ka9egw@britewerkz.com>
Subject: [R-390] Line Level meter

Having solved the mystery of the 3rd wire...one of my sub-projects is figuring out the dropping resistor to use with a physically-correct 1mA meter movement [matches the 390 meters but it's just a 1mA DC meter, no internal rectifier/cap like a true VU meter] and a bridge rectifier to make a Line Level VU meter 0dBm is 1.228Vrms, so for 0dBm to be half-scale...lessee...check my math here... $1.228\text{vrms}=1.754\text{v peak}$, or 3.508v pk-pk. That makes 0dBm is 3.5V [assuming a capacitor-input filter so output approximates Vpk-pk w/a bridge rectifier].

However, the meter face .pdf I can print repro meter faces from looks to have 0dBm at about 2/3 scale, which means 3.5V at 0.67mA equals 5.22K ohms. 5.1K ought to be close enough, whaddy think? Or ~2.4K with a single diode? No need to worry about what to do with the cold end of the bridge that way...

Date: Wed, 25 Aug 2010 07:37:02 -0500
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] Line Level meter

I can do the math if it was a simple sine-wave power supply, no problem. Assuming, of course, the line's ability to source without being loaded down... which I kind of doubt given the low levels we're talking about... Wikipedia says "The typical VU scale is from -20 to +3. The rise and fall times of the meter are both 300 milliseconds, meaning that if a constant sine wave of amplitude 0 VU is applied suddenly, the meter will take 300 milliseconds to reach the 0 on the scale. It behaves as a full-wave averaging instrument, and is not optimal for measuring peak levels." AH-HA. Til now I guess I've been trying to figure the deal for a peak-reading meter. Another good reference [which unfortunately adds little value to my design process] is at http://www.aes.org/aeshc/pdf/mcknight_qa-on-the-svi-6.pdf. In either case, a 1mA FS, 100-ohm internal-resistance, non-radioactive meter movement is what I have to work with. I kept two out of the batch I offered to the list maybe a year or so ago. Here's another go at it:

Sanity check: figure zero forward drop with a [Cu2O] fullwave bridge, .
 $775/.00067=1156$ ohms, still a long ways to go to get to the 3K-plus in the original spec. I can only figure the original meter's movement was something *significantly*

more sensitive than 1mA FS. Looks like I'm going to have to put an op-amp in there. Dadburn it. After opening up the meter to check for any internal resistance, natch...

Or I may just plug the meter in the hole for looks and say the heck with it. Or configure it as an S-meter to read the AGC line. But I haven't given up yet. More thought is indicated.

Date: Wed, 25 Aug 2010 09:37:23 -0400
From: William A Kulze <wak9@cornell.edu>
Subject: Re: [R-390] Line Level meter

For what it's worth, some years ago I stumbled upon an old VU meter from some other application and it worked just fine as a direct replacement. I didn't do any measurements, but it seemed to do just fine.

Date: Wed, 25 Aug 2010 12:23:11 -0500
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] Line Level meter

OK, I found a pcb for six bucks which runs off a single positive rail supply [which I can tap from the filament or pilot lamp circuit] and uses a single TL071 op-amp and a handful of diodes and resistors, and presents a line load of about 100K or better. Total board size looks be about an inch and a half square. The complete kit is about twenty bucks. Still cheaper than trying to source an original meter. It's doable.

From: Mike Sullivan [mailto:kc2kj@clear.net]
Sent: Wednesday, August 25, 2010 12:59 PM
To: ka9egw@britewerkz.com
Subject: Re: [R-390] Line Level meter

Where did you find the pcb?

Date: Wed, 25 Aug 2010 14:09:58 -0500
From: <ka9egw@britewerkz.com>
Subject: [R-390] FW: Line Level meter
To: <r-390@mailman.qth.net>

www.jlmaudio.com the part number is VUBUF;
The bare board is p/n VUBUFPCB

Date: Tue, 21 Sep 2010 08:38:43 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] R390A Audio Meter FS

The usual place. COLLINS RADIO R-390A METER Audio 0 Bids \$9.95
140455917696

Date: Tue, 21 Sep 2010 11:51:14 -0400
From: Barry <n4buq@knology.net>

Subject: Re: [R-390] R390A Audio Meter FS

I believe that's a Carrier Level meter, isn't it?

Date: Tue, 21 Sep 2010 12:07:03 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R390A Audio Meter FS

Yes, it is marked with the face of a carrier meter. However, we must keep in mind that BOTH meter movements have the SAME characteristics! Only the face determines what it is used for. One can always procure it and change the face for use in the "other" position. As always, YMMV and the appropriate caveats and precautions apply!

Date: Tue, 21 Sep 2010 09:22:19 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] R390A Meter Mistake

Barry is correct. Sorry for the error.

Date: Tue, 21 Sep 2010 12:41:29 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] R390A Audio Meter FS

Both meters had a 17-ohm internal resistance?

Date: Tue, 21 Sep 2010 12:48:02 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R390A Audio Meter FS

As far as I have been able to determine. Same full scale current also. Then again I have been known to make the infrequent error or two! Some nasty thing about being HUMAN! (LOL!)

Date: Tue, 21 Sep 2010 10:39:31 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] R390A Audio Meter FS

Who'd have thought! That opens up some possibilities. So I take it you took apart an audio meter to get past the rectifier and maybe a resistor?

Date: Tue, 21 Sep 2010 14:15:00 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R390A Audio Meter FS

Please pull out the TM 11-856A. As you go through the schematics, you'll note the BOTH meters have a + and a - connection. Keep digging and reading..... These are the SAME interior devices with different faces.

Date: Tue, 21 Sep 2010 12:00:58 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] R390A Audio Meter FS

Not yet. The only place it's marked with a polarity is on the Mainframe Wiring pictorial diagram, and that's nonsense, because M101 is fed with audio AC. That puts at least a rectifier inside, so although you can determine the FS current externally, to measure the resistance you have to bust it open. It could be a 17-ohm movement, but you haven't proven it. I hope it is...

Date: Tue, 21 Sep 2010 14:03:38 -0500
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] R390A Audio Meter FS

Take a look at the lower right corner of page 188 of TM-11-856A. The line level meter isn't connected to *anything* but a handful of range resistors and their associated switch wafers, all on the secondary of T602--the line out transformer. And there are no "+" or "-" by M101, which is indicated by a simple circle with "VU" inside it. Moreover, one side of M101 is connected directly to one side of T602's secondary. There is no diode shown anywhere in that part of the circuit. Where in TM11-856A are you looking? The schematic on page 188 shows no way [barring a short between windings of T602] for DC to get to M101. If somewhere else in the manual M101 is shown with polarity markings, then we do indeed have a puzzle.

Date: Tue, 21 Sep 2010 15:20:43 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R390A Audio Meter FS

I suggest you go look at TB-102.
Note the CR-xxx that is mounted there.

I wasn't aware that anyone needed to "prove" what is in the circuit or the manual. I simply restore these for MY purposes. One '67 EAC and a Collins '51 contract from St. J's. Members of the list have a tendency to focus in on "small" areas, NOT open their minds and eyes to the WHOLE!

Date: Tue, 21 Sep 2010 15:34:43 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R390A Audio Meter FS

Try Figure 105. Both M101 AND M102 are shown with polarity markings alongside their "symbols".

Date: Tue, 21 Sep 2010 12:39:54 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] R390A Audio Meter FS

TB102 serves multiple purposes. CR101, between terminals 3 and 5, is for Diversity AGC. Terminals 1 and 2 let you open-circuit the RF GAIN control.)

Terminals 6-8 are LOCAL AUDIO. The LINE AUDIO output is actually on TB103, terminals 10-13. If you go to TM11-856A Figure 5-13, Schematic Sheet 4 of 4, in regions 1A to 4C, you will see that M101 has no polarity and (with an attenuator pad) is across the secondary of LINE AUDIO transformer T602 with no diode in sight.

Date: Tue, 21 Sep 2010 19:16:58 -0400
From: "Stephen M. Murphy" <murphys@comcast.net>
Subject: Re: [R-390] R390A Audio Meter FS

In my Motorola, the meters are definitely not the same: Line is set up for measuring AC and Carrier for DC. The Carrier meter cannot be used in the line position; it'll just bounce about the left peg. No question... done it before. I suspect that the line meter would show at least some deflection if wired into the carrier circuit with the correct polarity. This is an educated guess, haven't tried it myself. If I recall, the specs are different for the two meters; about 3500 Ohms for the Line and 17.5 for the Carrier. Dunno if they varied over the years, but that's how mine is...

Date: Tue, 21 Sep 2010 19:11:36 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] panel meters

I think that you are correct. Here is some earlier posts re these meters that are of interest to all:

Date: Fri, 22 Jan 1999 17:27:08 +0100
From: Rolf-Lutz@t-online.de (Rolf Lutz)
Subject: [R-390] R390A Meters

In HSN 22 Page 2 is a specification of those 2 meters. The R390A line meter is 250 μ amps full scale, 3360 ohms internal resistance The R 390A carrier meter is 1 mA full scale 17.7 ohm internal resistance. Even a small error (high or low) in the internal resistance of a carrier meter will cause rather large errors in carrier meter readings (Dalles Lankford) Spring 1980

Date: Fri, 4 Nov 2005 19:56:51 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Another 390A Carrier meter question

Sad things I have to say. The R390 carrier level meter is un scaled to any standard. Never was. Never was taught in school to be related to any thing. It was just a nifty tuning indicator that let you sort of know when you had the signal in the band pass or the receiver.

The zero point was never an easy thing to set. It was the only specification for the meter circuit. We never tried to even get them to zero for the operators. We left them laying a bit off the left peg just so that whatever signal did come alone was not lost before the needle got off the peg. Some of the guys have used 10 turn pots to get a better zero. Some have used 10 Ohm pots and made up the rest of the resistance

with fixed resistors to make the zero a little easier to set.

If you have a signal that puts the needle up about mid scale, you likely can bite down on a chewing gum wrapper and detect the signal in your mouth on one of your fillings. Sensitive the circuit is not. Calibrated is not used in reference to the meter circuit. One side of the meter is set to a small positive voltage by the current drawn through R548. This is a 27 ohm cathode resistor for the AGC time constant tube. When you change the AGC speed, the change in voltage causes the meter to peg. This is all normal. The 5814 sections draws a little less current than the 6AK6 so its 27 ohm resistor balances some where with the resistance in the 6AK6 cathode circuit.

On the other side of the meter the stock 100 ohm resistor shorts a 22 ohm resistor. So the carried meter adjust varies from 0 to 18 ohms. The circuit is a voltage meter to measure the voltage drop across the bottom end of the 6AK6 fourth IF cathode resistor. The tube always conducts. There is always some voltage drop. Placing the other side of the meter against the AGC tube cathode resistor just offers a zero point for zero signal.

Once a signal hits the grid of the 6AK6, the tube conducts a bit harder. A little more voltage is developed across the metered section of cathode resistor and the meter will move up scale. 6AK6's will change in gain with any variable you would like to mention. A calibrated circuit it is not. Nowhere is the developed signal in the receiver run across a fixed resistance and the magnitude of power metered. The line level output meter is as close as you get to a metered signal. This is just the audio level developed and has no calibrated relation to the RF signal strength.

The meter is nice and it functions as designed. A S meter it was never intended to be.

Roger KC6TRU

Date: Wed, 22 Sep 2010 09:56:18 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] R390A Audio Meter FS

I would be delighted if they were the same. There's no compelling technical need for them to be different, but VU meters for a 600-ohm line are a standard item.

Date: Thu, 23 Sep 2010 12:18:36 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Meters

The line level meter is a straightforward device. Measuring AC voltage through the resistor network attached to it. It is probably nice and linear (with maybe the exception of frequency response). The carrier meter is measuring DC and with that carrier pot and everything else around it is probably not linear and has no reference to any particular number (like S-Units, uV or dBm). As has been said by others it has mostly been a tuning aid and not something that you could use to compare the merits of one receiver against another or even what you may have done during an alignment.

For alignments I use a Sinadder and a really good, accurate signal generator with some decent attenuators. I have been tempted to create a new scale for the carrier meter (and the line meter while I am at it) that would really represent some "value" but after hacking around in that carrier circuit I just found the results not that easy to replicate (comparing the signal generator output in dBm against the Sinadder and the meter movement, even across different 1 MHz bands).

Thinking about what the original R-39x designers had in mind, they were not trying to create a piece of precision laboratory equipment. The carrier meter movement is just relative. The line meter movement is a bit more important if you are pumping audio into a phone circuit or a recording device.

Date: Thu, 21 Apr 2011 11:21:43 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Panel meters

This may be blasphemous but I always wanted to change the panel meters from white on black to black on white with some additional scaling.

We have the JPEG and TIFF renderings of the panel meter faceplates but they are very grainy looking

I figured if I went with black on white I could laser print it in vellum paper and glue it to a translucent bezel. Remove the old, radioactive bezels and add backlighting to the meters.

Before someone gets all excited about me handling radioactive materials I used to be licensed to handle radioactive sources (Cobalt 60, Radium 226, Cesium 137, Americium 241, Polonium 210), including those that posed a threat of airborne contamination so I know the right steps, have the proper clothing and respiratory protection and have the equipment to monitor for external contamination (alpha, beta, gamma).

Definitely not something I would want to (or legally could) do for someone else. The freaking NRC would be all over me if I went into the home business of retrofitting radioactive panel meters or dial knobs.

Date: Thu, 21 Apr 2011 12:28:54 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Panel meters

While not on an R390A meter, I had good success painting a meter face white and using a laser-printed, water-based decal.

Date: Thu, 21 Apr 2011 10:45:22 -0700
From: Dennis Wade <sacramento.cyclist@gmail.com>
Subject: Re: [R-390] Panel meters

I'd like to hear more about how one would add back lighting to a meter; not just the '390A meters (hazardous material issues), but backlighting meters in general.

Date: Thu, 21 Apr 2011 14:06:52 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Panel meters

It "may" be very difficult to back light the meters in an R-390A. The dial face is NOT translucent.

Measurements would have to be taken, and then see *IF* there is room at the top, between the dial face and the glass to "squeeze" an LED in that space. I'm pretty positive that the hard drive style "flat" ones could fit. It would require a small slot to be cut into the meter body! To keep the LED from being harsh, the surface could be either "etched" or "roughed up" with an abrasive to dim it down. I don't know if a round one would fit. Then again, I haven't given a lot of thought to lighting them.

Most of the meters that have back lighting, have transparent or translucent bodies, AND either the lamp is outside the meter, or the dial face is at "least" translucent, so that the light can come through.

Date: Thu, 21 Apr 2011 14:59:46 -0400
From: Curt Nixon <cptcurt@flash.net>
Subject: Re: [R-390] Panel meters

Remember those little Christmas trees with a light in the bottom and all the branches are plastic fiber? An LED with a couple of strands of FO on it will get into some pretty tight spots. Makes changing the LED very easy also and only tiny holes required, if that, into the meter.

Date: Thu, 21 Apr 2011 14:02:44 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Panel meters

To go about it in the way I am considering I would use a plastic bezel, sort of the same thickness as the plastic lid on a coffee can but translucent white so it diffuses the light evenly. I would print the dial face using a color laser printer on a very thin paper like vellum or onionskin.

I have done similar things before with other meters but really need to buy a junker R-390A panel meter so I could experiment with how much room there is to work with.

In modern times I will probably use a low intensity white LED and add a second set of connections on the case for the dial lamp connection. A dab of hot glue would hold the LED in place and provide illumination from behind the diffused plastic with enough distance so it does not leave a bright spot. You can do that with some of the LED's that have different lighting patterns.

Date: Thu, 21 Apr 2011 14:05:27 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Panel meters

You will probably need to add a blob of something to diffuse the light from the end of the fiber strand. That is a great idea, less intrusive, to use a small length of fiber to get illumination back there. After all a single strand is only 125 micrometers in size (with cladding, 62.5 micrometers when you bare it down to the glass strand). (most commonly used multimode fiber)

Date: Thu, 21 Apr 2011 16:43:57 -0400
From: Curt Nixon <cptcurt@flash.net>
Subject: Re: [R-390] Panel meters

I haven't looked at one directly, but one might add a "window" in the appropriate place in the case by drilling a hole and then plug the hole with a pc of white or clear translucent plastic rod. A hobby store is your best friend for projects like this. Maybe even replace one of the assembly screws with one of plastic then light it up from outside. Just some ramblings.

Date: Thu, 21 Apr 2011 18:34:05 -0500
From: "Ron.K3PID" <ron.k3pid@sbcglobal.net>
Subject: Re: [R-390] Panel meters

I have used printable label stock in the past. It comes in several colors even two or three shades of white and when you print it and are ready to apply, just peel off the backing... I have also printed white letters on black although it uses a lot of ink, a laser printer works best for the white on black.

Date: Thu, 21 Apr 2011 22:47:32 -0500
From: "keller family" <kellerfamily01@charter.net>
Subject: [R-390] Panel meters

White faced meters are not totally alien to the R-390A; the military did use some radios with white faced meters. In fact, I have a photo of an R-390A being used in an intercept position that has a white faced line level meter, and I have a new line level meter that has a white face.

Date: Sat, 23 Apr 2011 10:16:49 -0500
From: Barry Williams <ba.williams@charter.net>
Subject: Re: [R-390] Panel meters

I have a '56 Motorola that came with the pair of white faced meters. I swapped them with another 390A.

Date: Sun, 24 Apr 2011 10:39:52 -0600
From: Robert Moses <rhmoses@earthlink.net>
Subject: Re: [R-390] Panel meters

Another way to avoid a 'bright spot' is to paint the inside of the meter enclosure white and then use a normally directional LED to illuminate the white insides of the meter case. A higher intensity LED may be in order to get the lighting level the way that you want.

Date: Mon, 25 Apr 2011 11:12:57 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] panel meters

I have the dial off of a R44/ARR-5. It is a thin plastic disk with a black background and transparent MC markings etched (?) in.

Would it be possible to make such a dial face to fit both R390A meters and have it backlit with a LED? What would it take? Thanks for your thoughts

Date: Tue, 26 Apr 2011 11:23:43 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] panel meters

I think it is a great idea. I think that the grungy finish on the existing meters detracts from a really nice restore. You could even put a low powered green LED in there to give a really sharp looking replication of what those panel meters would look like when the radium paint was fresh and in a dark room. Now we need to find someone who can make plastic bezels and a negative stencil.

Date: Tue, 26 Apr 2011 13:00:13 -0400
From: Curt Nixon <cptcurt@flash.net>
Subject: Re: [R-390] panel meters

Most vinyl sign shops can cut negative paint mask or negative vinyl using a laser cutter. But you might better use a positive resist..Apply the lettering to the plastic bezel, spray paint over all, then remove the letters leaving the clear through to the plastic. This could also be done with a custom dry transfer. About 25.00 US per 8x11 sheet with any artwork. Like the old rub-off lettering but any artwork at a ll. I have used this supplier for technical one-off instrumentation and also model work. <http://www.allout-graphics.com/>

Date: Tue, 26 Apr 2011 13:04:13 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] panel meters

I know it has been a good chunk of a century since I saw a truly fresh radium dial glow but I would describe it today as greenish-whitish. Don't know how much of the glow is the radium and how much is phosphorescence in the paint. I think anything since the 60's is promethium or tritium.

A true repro/litho shop would be able to make jet-black transparency stencils (far superior to what you could do with a laserprinter or inkjet although, those might be good enough).

Date: Tue, 26 Apr 2011 17:31:02 -0700 (PDT)
From: Masters Andy <nu5o@yahoo.com>
Subject: Re: [R-390] panel meters

The owner is a very nice gentleman.? I suppose if there were a reason to re-manufacture meters and the demand was enough-they could do it.

Date: Tue, 26 Apr 2011 18:31:14 -0700 (PDT)
From: Masters Andy <nu5o@yahoo.com>
Subject: [R-390] panel meters with link

<http://larsonmetercraft.com/>

Date: Wed, 27 Apr 2011 06:39:43 +0100
From: "Lester Veenstra" <lester@veenstras.com>
Subject: Re: [R-390] panel meters with link

So, has anyone asked them to make replica Line and signal level meters?

Date: Wed, 21 Mar 2012 17:11:47 +1300
From: Ken Harpur <igloo99nz@yahoo.co.nz>
Subject: [R-390] Sticking Carrier Meter

I have a sticking Carrier Meter on my Stewart Warner R-390A and I was wondering if there is a safe way to fix them. I read an account online where someone had opened one up and relaxed the screw for the meter movement about 1/4 turn (if memory serves). That cured the problem and meter was as good as new...but really, how safe is this? I think I already know the answer but just wanted to check with you guys first. I'd rather buy one than open one up if my health is going to be at risk. On that note...does anyone have one spare they'd like some \$\$\$ for? (silly question I know...hihi!!) <snip>

Date: Wed, 21 Mar 2012 07:24:06 -0500
From: "chacuff" <chacuff@cableone.net>
Subject: Re: [R-390] Sticking Carrier Meter

The meter can be opened and work done on it with some minor precautions. I would wear a breathing mask...simple paper type used for medical uses should be fine..just to trap anything you might create floating around in the air. Most importantly...don't lick the meter faces....that's the word on the list.

Wash your hands good after your work...
With that you should be good to go.
Not too much worry we are told....

Date: Wed, 21 Mar 2012 08:47:18 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Sticking Carrier Meter

I would do that outside as well.

Date: Wed, 21 Mar 2012 12:26:09 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>

Regarding the potential for radioactive exposure or contamination from panel meters;

I have worked with radioactive materials for most of my adult life, including leaking sources and gross contaminants. Most of what you will find in a panel meter would be Radium 226 mixed with a fluorescing material. As an external radiation hazard you would need tens or hundreds of times more radium than is used in a panel-meter to be any sort of risk. An old piece of orange Fiesta-Wear dishes is much more radioactive (they used uranium as a salt to obtain the orange color in the glaze).

Old radium paints become "friable". Meaning that they are prone to flaking due to the fact that it is; 1) an old paint. 2) radiation bombardment over decades has a tendency to loosen up paint particles. This means that you do not want to be touching or rubbing the painted surface as it can rub off. Once the material is loose then it becomes a potential external and internal contaminant. I would suggest a simple dust mask as has been mentioned by other and cheap surgical gloves when handling.

We had a few tricks that you can adapt to varying degrees;

1) apply a piece of clear shipping/ packing tape across the meter face. This fixes the radioactive materials in place and eliminates the contamination hazard. It does not look bad if you do it right and leave it in place when you are finished. Just trim up the edges of the tape.

2) Always work in a pre-cleaned area and make a little work area to capture any loose particles. If you have the packing tape, make it into a 6-10" wide loop with the sticky side out and let it adhere to your desk. Just work above this piece(s) of tape and any material that falls off will get stuck on the tape.

3) Thoroughly clean the area after you are done with soapy paper towels and water.

4) Thoroughly clean yourself (hands, face, arms, etc...) when you are done. This too is with "real" soap and water (not a guy's way of washing up that involves getting your hands wet and wiping them on your pants <lol>).

I only got "crapped up" one time where I had to leave my right shoe behind after walking around on the other side of the purple and yellow tape. Sometimes we would set off a hand and foot detector but one visit to the sink with soapy water and towels eliminated those contamination incidents. You definitely do not want to be grinding up the paint from a half-dozen panel meters and snorting it as Radium 226

is treated by the body like calcium and goes right to the bones.

Date: Wed, 21 Mar 2012 14:12:46 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Sticking Carrier Meter

What should be done to properly dispose of any dusty paint particles that happen to end up on the desk/tape?

Date: Wed, 21 Mar 2012 14:22:59 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Sticking Carrier Meter

Simply place in a "zip-loc" bag and dispose in the trash. You can if you so desire "attempt" to dispose as Hazardous Waste. This will only get you into a red tape rendition of Catch 22 that is NOT worth all the resultant issues, up to and including the confiscation of the meters. Radium-226 is an alpha emitter. The particles in question cannot penetrate skin, paper, NOR the suggested "Zip-Loc" bag. That is the short and simple solution.

Date: Wed, 21 Mar 2012 13:45:32 -0500
From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] Sticking Carrier Meter

Use sticky tape (wide packing tape works nicely) to "trap" the particles; then wrap the sticky tape up in some aluminum foil, and dispose with trash that will be buried in a land fill (i.e. not burned). If you want to be a "good citizen" - many communities have a "hazardous stuff" amnesty day once or twice a year for collecting everything from old batteries, tires, paints, chemicals, etc. - and disposing of them properly. You could see if such is available - and soon enough to matter. However - the level of contaminants being discussed here - short of ingesting them - are relatively harmless (compared to background, etc.); so "trapped" and buried where they won't be disturbed for a long time - is a proper way to dispose of them.

Date: Wed, 21 Mar 2012 15:05:46 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Sticking Carrier Meter

Randy is correct in using aluminum foil, however it really isn't necessary. Between the particles being trapped by the tape itself, and placing in a relatively thick "Zip-Loc" bag is more than adequate. I have a very reluctant view of the local Hazardous Waste drop off day. The first thing they want to know is - "What is it?". Answering correctly will result in a wild flurry of activity. They WILL want the "source" of the material. Since this is a reversed loop of mylar backed tape, it is going to be four layers if folded over. Placed in a "Zip-loc" bag now adds a layer of fairly substantial polyethylene on each side. When this goes to the landfill, it will be well buried, and be the "least" of those things that we worry about. More mercury is in the landfills of this country than any other thing that causes a hazard. It happens to be in liquid form, and has been a source of grief for longer than we can

remember.

Date: Thu, 22 Mar 2012 15:56:00 +1300
From: Ken Harpur <igloo99nz@yahoo.co.nz>
Subject: Re: [R-390] Sticking Carrier Meter

Thank you Tisha and everyone else that responded...there is some really good info here. I initially thought of suiting-up in old shoes, paper overalls, gloves and dust mask and doing it outside but I wonder about any flakes becoming air-borne...perhaps I'm just over-thinking it. I will go with the shoes, overalls, gloves and mask and work in an area where I will be undisturbed. Really all I intend to do is get in there, relax the screw for the meter movement and get out again. Thanks again for the replies, there is some great info in the post below. I will use the tape idea and also dispose of it in a zip-lock bag along with the mask etc...

Date: Fri, 23 Mar 2012 17:11:44 +1300
From: Ken Harpur <igloo99nz@yahoo.co.nz>
Subject: Re: [R-390] Sticking Carrier Meter

Yours and Tisha's posts have certainly eased my mind somewhat...until a few days ago I was considering stalking eBay until one came up for sale. Having informed information like this from people who know about these things certainly is a luxury. I will follow the advice given by Tisha and yourself and just do the tape loop, mask and gloves. I feel a lot better about the whole thing now that I know as long as I'm sensible it really isn't that big a deal. I've owned my R-390s about four or five years now...I'm very lucky to have three 'A's and one non-'A' and I'm slowly working my way through restoring them. Anyway, ever since I found out about these radios, bought some, joined this list and studying various websites including occasionally browsing the archives...I came to the conclusion the general consensus was not to even think about opening one up. Sooooo...! I'll get onto it this weekend and let everyone know how it went...

Date: Fri, 23 Mar 2012 00:41:51 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Sticking Carrier Meter

One thing before you dive in: I believe you mentioned loosening the movement screw as a potential fix. If anything, the meter bearings should have more clearance now than they did when the meter was new, due to wear. So it is probably not advisable to loosen the bearing screw, unless you can clearly see that some physical damage has moved one bearing closer to the other (almost certainly not the case). The cause of the sticking is much more likely to be (i) crap in the magnet assembly rubbing on the armature, (ii) something else rubbing (needle on face, spring on wire, etc.), or (iii) dirt/grime in the bearings. Loosening the bearings won't help the first two, and even if it helps the third, it is the wrong thing to do and the "fix" won't last long. Figure out what is the matter, and fix that. If it's dirty bearings, use a *non-magnetic* small pointy thing (e.g., plastic toothpick) to put solvent in each bearing, then exercise the meter, then put in more solvent, etc., etc. When it is free, use the pointy thing to put the smallest drop of very light oil on each

bearing. (Light mineral oil like sewing machine oil or the oil that comes with electric shavers is good. Real watch oil is, too. Sperm oil, if you have any (which is probably what it had from the factory). Jojoba oil works fine if you can't find any of the others. Do NOT use 3-in-1 oil or similar oxidizing oils.

General axiom of troubleshooting and repair, # 17: Don't fix the wrong thing.

Date: Fri, 23 Mar 2012 20:45:24 +1300
From: Ken Harpur <igloo99nz@yahoo.co.nz>
Subject: Re: [R-390] Sticking Carrier Meter

Thank you Charles, the points you raise hadn't even occurred to me. I just assumed it was the bearing screw because I had read on an R-390A site that the owner had relaxed that screw and it worked for him. After reading your comments I consulted google again to try and get some more ideas and came across a link that suggested one of the most common causes of sticky meters is as you say in your first point... "The cause of the sticking is much more likely to be (i) crap in the magnet assembly rubbing on the armature"

I'll have a good look at it when it is open and make sure I have identified at least a possible cause before I touch anything...and given what you say about the bearings I think I'll leave that screw alone.

Once again thanks for the advice I will use it all to try to fix it...hopefully I will be able to come back to the list with good news!!

Date: Fri, 23 Mar 2012 16:45:52 +0100
From: "Prof. Johannes Fischer" <prof.johannes.fischer@t-online.de>
Subject: [R-390] sticking Carrier Meter

My humble suggestion: it may not be solved by turning the screw. Sometimes there is just a tiny particle between magnet and coil. Very thin adhesive tape to put between, which collects the tiny particle. That should be the first step before anything further.

Date: Sat, 14 Apr 2012 17:29:42 -0700 (PDT)
From: David <davidbr549@yahoo.com>
Subject: [R-390] R-390 & R-390A Replacement Meters

This link shows how some meters may be modified as replacements.
<http://www.qsl.net/kh6grt/page4/R390meters/pictorial/pictorial.htm> David

Date: Sat, 14 Apr 2012 21:49:37 -0500
From: Gary Pewitt <garypewitt@centurytel.net>
Subject: Re: [R-390] R-390 & R-390A Replacement Meters

Very nicely done. Thanks for posting.

Date: Sun, 15 Apr 2012 10:43:33 -0400 (EDT)

From: Roger Ruzzkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] R-390 & R-390A Replacement Meters

Nice job. Nice to see the small amp board. There are lots of nice meters out there that will fit as well as your pair. Nice to see that a pair can be adapted to give the receiver a nice balanced look with the replacement.

Date: Sat, 21 Apr 2012 12:53:39 -0400 (EDT)
From: Roger Ruzzkowski <flowertime01@wmconnect.com>
Subject: [R-390] Carrier Level Meter reading with calibration

>Calibrator circuit . What sort of variation should be expected in the
>Carrier Level Meter reading for different calibration frequencies?

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A lot. Each megahertz band uses a different crystal harmonic being produced at a different oscillator level. As the signal goes through the octave filters (.5-.999, 1-1.999, 2. 3.999, ... 16- 31.999) the pass level is different. The VFO may even have different levels from end to end or in between. What the output level will be on any frequency is just the sum of many parts and relative to nothing. As long as the out put signal is use full to your ears, your receiver is OK.

Date: Fri, 3 Aug 2012 13:48:57 -0500
From: Dave Merrill <r390a.urr@gmail.com>
Subject: [R-390] Possible Line Level Meter Replacement??

Saw this on eBay - item 120961442219 - the dimensions are right, plus it's lighted. It's a little pricey and he doesn't seem to offer any 1mA meters that would be suitable for a matching Carrier Level meter which is too bad.

Date: Fri, 3 Aug 2012 12:15:48 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Possible Line Level Meter Replacement??

The description should go on Best Of Babelfish. "Influenza pointer"? I wonder who his target is? Not us, being he posted it in "Consumer Electronics|TV, Video & Home Audio|Other". More likely it's audiophile neep-neepers. I can understand a VU scale, but what's "GR"? Pretty far-out neon since it strikes at 12V. (Never mind, I'm just snarking.) 0dBm in a 600-ohm circuit is .775V not 1.2V, but I think he really means +3dBm which is 1.1V which is close. Beats a hole but I'd keep looking.

Date: Fri, 3 Aug 2012 12:45:44 -0700
From: Dennis Kidder <w6dq@att.net>
Subject: Re: [R-390] Possible Line Level Meter Replacement??

G/R = Gain Reduction Probably used in a compressor/ limiter. Looks like the lower scale shows GR. I haven't the foggiest idea what an influenza pointer might be.

Date: Fri, 3 Aug 2012 14:54:34 -1000

From: pete wokoun <pwokoun@hotmail.com>
Subject: Re: [R-390] Possible Line Level Meter Replacement??

Not a bad looking meter. You could always rescale this Vu meter to match the 390 scale. And you could buy a second one and rework it as a equivalent carrier level meter. And they would match, too. But about \$140 and a lot of hours of work is a large investment. I was selling a pair of usable, lighted meters a few years back for \$50 and I got ZERO response. I guess folks preferred a hole rather than non-originals. 390s have since taken a back seat here. You can see what I offered at:
<http://www.qsl.net/kh6grt/page4/R390meters/meters.htm>

Date: Fri, 3 Aug 2012 18:20:41 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Possible Line Level Meter Replacement??

If my radio had come with holes, I wouldn't have hesitated to buy your retrofits.

D

<snip> O

D

Date: Wed, 15 Jan 2014 08:14:40 -0600
From: "KA9EGW" <ka9egw1@britewerkz.com>
Subject: [R-390] meter luminescence

Seen plenty of blah brown meters that do nothing but move the pointer, in '390's and '390A's, in my day. Never before seen ones where the markings glow a "Luna Moth green" after exposure to light, like the hands on a Big

Ben clock of some years back. Were there actually meters that had the strontium aluminum silicate [I'm guessing at the composition here] rather than the radium? 73, Brian KA9EGW

Date: Wed, 15 Jan 2014 10:20:55 -0600
From: "Ted Breaux" <tbreaux7@comcast.net>
Subject: Re: [R-390] meter luminescence

Plutonium is known to do that!

Date: Wed, 15 Jan 2014 11:01:50 -0600
From: barry williams <ba.williams@charter.net>
Subject: Re: [R-390] meter luminescence

Here is a link to a short history of radium dials and radium girls:
<http://www.roger-russell.com/jeffers/radiumdials.htm>

Date: Wed, 15 Jan 2014 12:18:19 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] meter luminescence

The idea of plutonium on dial faces is absolutely absurd! It takes a uranium fission process to create plutonium - period. The radioactive material - plutonium - is HIGHLY radioactive and will remain so for some 24 ** (4) or longer. IOW - 24000 years for the half-life. The military has NEVER used such. The only radioactive elements used, have been radium, and tritium.

Date: Wed, 15 Jan 2014 12:24:03 -0500
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] meter luminescence

Not R390/390A meters, that I'm aware of. They were all radioluminescent, not photoluminescent.

Date: Wed, 15 Jan 2014 13:27:28 -0500
From: Adam Vaughn <AdamAnt316@verizon.net>
Subject: Re: [R-390] meter luminescence

The meters on my '67 EAC R-390A have lighter-colored markings than the eter on my '51 Collins R-392. The R-390A meters do indeed show a small, brief amount of green glow when exposed to a bright light source, such as a camera flash; the R-392's meter shows nothing. Testing with my Cold War-era Victoreen CDV-700 geiger counter shows very little radiation from the R-390A's meters, while the R-392's meter is very 'hot'. The substance in the paint on these meter markings which actually glows is apparently zinc sulfide, which degrades much quicker than the radium which induces the glow -Adam

Date: Wed, 15 Jan 2014 13:31:43 -0500
From: Roy Morgan <k1lky68@gmail.com>

Subject: Re: [R-390] meter luminescence

Thanks for this report and information about the materials.

May I offer this for consideration:

Morgan's Rule for Radioactive Meters and Tubes

DON'T BREAK THEM OPEN AND EAT THE INSIDES!

Date: Wed, 15 Jan 2014 13:43:47 -0500

From: rbethman <rbethman@comcast.net>

Subject: Re: [R-390] meter luminescence

The Victoreen CDV-700 Geiger Counter *must* be detecting secondary byproducts. Radium is an alpha particle emitter. Alpha particles will not even penetrate paper or unbroken skin. The only way to detect alpha particles with such a device would mean that the meter has been opened and exposed to the surroundings. Additionally, the CD versions of counters are very coarse and only read in high ranges. It would require something such as an Eberline 500 to get accurate readings.

Date: Wed, 15 Jan 2014 13:54:22 -0500

From: rbethman <rbethman@comcast.net>

Subject: Re: [R-390] meter luminescence

Specifics on the CDV-700 Model:

The CD V-700, as a true Geiger counter, is capable of measuring ambient background levels of gamma radiation and detecting the presence of beta radiation in the environment, and thus can be used to detect such common low-level radioactive artifacts as uranium-doped marbles, Fiesta ware plates and radium watch faces. This differentiates them from other civil defense radiation meters such as the CD V-715, CD V-717 and CD-V-720, which are ion chamber meters that can measure gamma radiation levels far above (up to 500R/h) what the CD V-700 can (up to 50mR/h). Conversely, the ion chamber units are so insensitive to low-levels of gamma radiation that no legally exempt radiation source can make them register at all.

This makes them rather useless for use other than nuclear warfare.

Which is precisely what they were designed for, and have not been produced for over 50 years.

Date: Wed, 15 Jan 2014 14:42:50 -0500

From: "Todd, KA1KAQ" <ka1kaq@gmail.com>

Subject: Re: [R-390] meter luminescence

I've got a Simpson Carrier level meter with a brighter green glow, Brian.

In fact, one or two of the BFO vernier dials here used for the RATT mod have the 'luna moth green' glow. I don't think they're radioactive, though.

More interesting, a Line level meter I have actually glows blue. The needle

and legend are a light tan color in the natural light. No markings beyond Type 8, O(or Q)VS Inc., mod 150, and SEALED DO NOT OPEN. Asked about it here some years back, no one knew. Would love to find a Line level meter to match it. It's a purty blue color, too. Really stands out.

Date: Wed, 15 Jan 2014 14:56:36 -0500 (EST)
From: Gordon Hayward <ghayward@uoguelph.ca>
Subject: Re: [R-390] meter luminescence

I put a dosimeter next to the carrier meter on my 390A and it has shown no more than the expected background for the last 8 years.

Date: Wed, 15 Jan 2014 13:56:37 -0600
From: "Ted Breaux" <tbreaux7@comcast.net>
Subject: Re: [R-390] meter luminescence

The plutonium comment was meant as a Joke.

Date: Wed, 15 Jan 2014 12:14:49 -0800
From: Jim Barrie <barrie@eos.net>
Subject: Re: [R-390] meter luminescence

I was at Fair Radio and stuck Geiger counter up to the meter face of an R-390A and it definitely read up scale. Other than it was a yellow CD counter, have no idea what it was accurately reading. I bought that one. So far I have not. Glowed in the dark, lost any body hair or had any body parts fall off.

Date: Wed, 15 Jan 2014 20:43:06 -0500
From: "Duffy Floyd" <duffy56@verizon.net>
Subject: Re: [R-390] meter luminescence

The radioluminescent paint in this era used Radium as the "active" agent. Radium is an alpha emitter when it decays. While it is possible some of the daughter products give off a VERY slight amount of gamma or beta particles as they decay, the VAST majority of all radiation from these meters is alpha radiation. Alpha radiation is able to shielded by single layer of dead skin so unless the meter face glass is broken there is NO chance of alpha contamination. Any concern about alpha radiation relates to if it is ingested. Moral of the story.....don't eat the needles or meter faces.

>From everyone's favorite source of info....Wikipedia :-)

In the second half of the 20th century, radium was progressively replaced with promethium-147. Promethium is only a relatively low-energy beta-emitter, which, unlike alpha emitters, does not degrade the phosphor lattice and the luminosity of the material does not degrade so fast. Promethium-based paints are significantly safer than radium; the Pm-147 half-life is however only 2.62 years, it is therefore not too suitable for long-life applications.

Promethium-based paint was used to illuminate Apollo Lunar Module electrical switch tips and painted on control panels of the Lunar Roving Vehicle.

"Radioluminescent paint was invented in 1908 and originally incorporated radium-226. The toxicity of radium was not initially understood, and radium-based paint saw widespread use in, for example, watches and aircraft instruments. During the 1920s and 1930s, the harmful effects of this paint became increasingly clear. A notorious case involved the "Radium Girls", a group of women who painted watchfaces and later suffered adverse health effects from ingestion. It is now recognized that radium paint requires great care in application, maintenance and disposal to avoid creation of a hazardous condition.

Radium dials were almost always painted by young women, who used to 'point' their brushes by licking and shaping the bristles prior to painting the fine lines and numbers on the dials. This practice resulted in the ingestion of radium, which caused serious jaw-bone degeneration and malignancy and other dental diseases reminiscent of phossy jaw. The disease, radium-induced osteonecrosis, was recognized as an occupational disease in 1925 after a group of radium painters, known as the Radium Girls, from the United States Radium Corporation sued. By 1930, all dial painters stopped pointing their brushes by mouth. Stopping this practice drastically reduced the amount of radium ingested and therefore, the incidence of malignancy, to zero by 1950 among the workers who were studied.

Radium paint used silver-doped zinc sulfide phosphor, usually doped with copper (for green light), silver (blue-green), and more rarely copper-magnesium (for yellow-orange light). The phosphor degrades relatively fast and the dials lose luminosity in several years to a few decades, despite the long half-life of the Ra-226 isotope (1600 years); clocks and other devices available from antique shops and other sources therefore are not luminous anymore, though they are still radioactive and can be identified with a Geiger counter. The dials can be renovated by application of a very thin layer of fresh phosphor, without the radium content (with the original material still acting as the energy source); the phosphor layer has to be thin due to the light self-absorption in the material."

Date: Wed, 15 Jan 2014 20:46:08 -0500
From: Adam Vaughn <AdamAnt316@verizon.net>
Subject: Re: [R-390] meter luminescence

Yeah, I should have clarified that when I got the 'hot' reading, I had the "beta shield" on the CDV-700's probe open, and the meter was pegged on the meter's most sensitive range (though at times, trying the next setting up showed some meter deflection). With the beta shield closed, the count was far lower, naturally, though I did get some deflection. I wasn't going for an accurate reading, just to see what reaction I got, and get a reaction I did! I also get a 'hot' reading from my Jefferson "Golden Hour" 'mystery clock' from the 1950s, as seen here:

<http://www.roger-russell.com/jeffers/jefhour.htm>

Unlike the R-39x meters, there's no glass cover to shield the radiation, so that could

explain the high readings. Still makes me nervous every time I have to put my fingers near the hands to set the clock...

Date: Wed, 15 Jan 2014 20:50:50 -0500 (EST)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] meter luminescence

I have (at least I think I still have) one of those clocks and I've wondered how "hot" it is. I thought about restoring it but don't relish the idea of handling the parts until I know more about it. The last I remember about it, I had the parts "well protected" in a plastic shopping bag so I'm not too worried about it. :)

Date: Wed, 15 Jan 2014 22:15:57 -0600
From: Chris <kc9ieq@yahoo.com>
Subject: Re: [R-390] meter luminescence

I was told by a rather well known physicist/ham that adding a new phosphorous coating on top of the old "burned" out paint would NOT work- That the radium must be much more closely bonded to the reactive particles for it to glow. Has anybody actually successfully revitalized the stuff using this method?

Date: Thu, 16 Jan 2014 06:26:32 -0500
From: Steve Hobensack <stevehobensack@hotmail.com>
Subject: [R-390] Radiation VR tubes

I knew this person that purchased a sleeve of VR tubes at a hamfest. Some of the tubes were marked with the radiation symbol. Apparently the radioactivity was to lower the strike voltage. What is the radioactive element inside?

Date: Thu, 16 Jan 2014 05:52:59 -0600
From: Chris <kc9ieq@yahoo.com>
Subject: Re: [R-390] Radiation VR tubes

Thorium on the cathode at the least, but all sorts of nasty stuff can be found in different tubes- Radium included. There are several possibilities listed here-<http://www.orau.org/ptp/collection/consumer%20products/electrontubes.htm>

Date: Thu, 16 Jan 2014 06:08:49 -0600
From: Chris <kc9ieq@yahoo.com>
Subject: Re: [R-390] Radiation VR tubes

I take that back- I guess most if not all VR tubes use a cold or oxide-coated cathode. The link previously posted goes into great detail about what isotopes may be found within, including VR type tubes specifically.

Date: Thu, 16 Jan 2014 08:29:16 -0500
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] Radiation VR tubes

According to Bell Labs scientists James Gewartowski and Hugh Watson, the electrodes of cold-cathode VR tubes are usually molybdenum. Krypton 85 or radium is often used to speed up the time it takes for the tube to begin conducting (what Gewartowski and Watson called a "radioactive keep-alive"), by creating a permanent supply of ions in the fill gas. (There are other "keep-alive" methods, but the radioactive method works well and is the simplest.)

Date: Mon, 4 Aug 2014 20:50:13 -0700
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] Testing old original meters for the R-390A

Bob, The carrier level is pretty easy - it's a 17.5 ohm 1 ma dc full scale meter. You can easily measure the resistance of it. The deflection is easiest measured with a vom in series with it connected to a battery and pot to adjust current. About 1.5v and 5k pot.

Date: Mon, 4 Aug 2014 21:32:41 -0700
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] Testing old original meters for the R-390A

Bob, You can hook the meter up to a 600 ohm output with a 600 ohm resistor across it and measure the ac voltage. It should be about 0.78vac at 0 db or 0 vu while hearing a 1kc tone. Or it should be @ 0.98 vac for 2 db.

xDate: Thu, 28 Aug 2014 10:39:16 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Carrier Meter Response

With all due respect to Dr. Lankford, it's the same old brute-force workaround, plus a few grace notes. It drives me crazy to see a band-aid on top of a mistake. Others may see it differently.

See my posts in the Pearls of Wisdom, panel_meters.pdf, from 2 Nov 2001 and 5 Nov 2001 (search for "TROUBLES ARE OVER"), and 10 Feb 2003. A trivial wiring mod corrects the underlying design flaw, repurposing the existing R523 as a current divider. Smooth, linear, full-turn adjustment range. It's so good you'll fall to your knees and weep. Well, maybe not, but you get the idea.

R537 controls meter sensitivity. In some radios you will have to additionally touch R548 or R549. These three are also the key to retrofitting a non-original meter movement, per Gary Gitzen's fine work starting in May 2006.

Sorry for the mangled ASCII art in my old posts - I have a sketch if there's a way to host it. A write-up too.

Date: Wed, 17 Sep 2014 19:40:11 -0400
From: Frank Hughes <fsh396ss@gmail.com>
Subject: [R-390] Meter test

Here is an interesting test of the meter emissions.
<https://www.youtube.com/watch?v=UUITKfrgkU8>

After looking up the dosage information, it is not enough to be concerned about, but a fun experiment, nonetheless.

Date: Wed, 29 Oct 2014 11:05:54 +0200
From: Grayson Evans <wa4gvm@gmail.com>
Subject: [R-390] Panel meters again

I am looking for replacement panel meters for my 390A. Not original, but more modern meters that will fit the holes. I notice there have been very long threads on this subject many years ago (the thread I have is dated 1999, hundreds of posts), which really didn't seem to resolve much except the specs for the meters. Wondering if anyone found a source they like lately. (the meters on the restoration I am working on are in pretty bad shape, but I am rebuilding them to keep as spares)

I found this company that makes a great looking replacement for the line level meter, but I am not sure they are actually available:
<http://www.sifammeters.com>

eBay has a zillion sellers of various conventional analog meters, most very inexpensive, but didn't see one I liked. It is fairly easy to modify the meter for the correct scale, and put a new printed scale on it (done it many times), if I can figure out the actual range of the meter movement (for example a labeled 0-100V meter is probably a 0-1 ma meter movement with a scaling resistor inside the case).

Date: Wed, 29 Oct 2014 08:02:32 -0500
From: Cecil <chacuff@cablone.net>
Subject: Re: [R-390] Panel meters again

They may fit the holes but will require drilling the panel for the attachment screws. That coupled with the mods necessary to make one function as an "S" meter properly and the cost (\$60 + s/h ea.) puts my vote squarely in the Find an Original pair column. They're still out there...a bit hard to find at times and no more expensive. Just my 2 cents worth..

Date: Wed, 29 Oct 2014 09:37:40 -0400
From: Roger Gibboni <rgibboni@dulye.com>
Subject: Re: [R-390] Panel meters again

The Simpson model 2121 is a replacement that is a direct fit--no mods required. It's a little more modern but definitely not as robust as the units you are replacing—

Date: Wed, 29 Oct 2014 11:13:00 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Panel meters again

I believe the meters listed on this page are a direct fit in the panel. I've ordered from

Leeds before and they were exact fits; however, I don't recall if they were the DeJur 112 (sold out) or the DeJur 131. Don't know if they ship overseas (if you need that).

Of course, it would help if I had included the link... :(

<http://leedsradio.com/parts-meters.html>

Caveat: It appears Leeds is not open for business for a little while due to moving locations (see their homepage).

Date: Wed, 29 Oct 2014 14:25:23 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Panel meters again

I wondered that myself. All I know is I've ordered meters like these from them before and they were an exact mechanical fit.

Date: Wed, 29 Oct 2014 13:38:50 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Panel meters again

if you know the internal resistance of the existing panel meter you could make a little circuit that has the same shunt resistance, tap either side of a resistor in series and run that into an op-amp, zero and span that to your hearts content and drive a different meter. (even, Gasp! a digital meter <joke>). Add a little bit of capacitance to the op-amp circuit, make the thing smooth out the values, etc...

You could steal power from the 6.3 VAC filament supply, run it to a little rectifier/regulator and mount that on the same board. Maybe even add a little internal meter LED light. (or a red flashy LED in the corner to show on peaks, that would be neat).

Sometimes I think we get too wrapped around the axle of maintaining an absolutely perfect reproduction of the panel meters. If you do not have the meters or you have bad meters there still are scavenged meters that show up from time to time on ePay. Heck, there is an entire industry of people who cannibalize R-390A's and sell them for their parts value, well in excess of the cost of an entire radio.

I do not advocate breaking up radios for parts but I have been the purchaser of many R-390A parts from a variety of sources. This is to the point where I could build complete radios just out of parts; just so I can have a spares supply.

The form-factor of the panel meters is pretty standard. I have seen them used in other radios of the same era. If someone was really motivated they could put just about any meter movement in one of those cases. If you had a shallow enough replacement meter movement you could install the little breadboard op-amp/scaling circuit behind it. Or you might be able to find a meter movement case that is deeper.

Thinking of a DIP-8 Op-amp package, three lead regulator, tiny little bridge rectifier, a few resistors and caps, two small pots for scaling, yea, that would be neat. It could

be mounted on a breadboard the size of a 50 cent piece.

Date: Wed, 29 Oct 2014 13:44:16 -0500
From: Dave Merrill <r390a.urr@gmail.com>
Subject: Re: [R-390] Panel meters again

I believe it means (R)emoved (F)rom (E)quipment

Date: Wed, 29 Oct 2014 12:35:29 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Panel meters again

In 2007, Gary Gitzen and I worked out an IF deck modification that permits use of just about any panel meter in place of the special 17-ohm meter originally used. Any 1mA meter of 100 ohms or less will work, including the original. Most meters with lower FS current can also be used. As an added benefit, the zero adjust action becomes smooth and linear.

Here's a textual description. Full writeup and schematic available on request.

Disclaimer: This mod may rub some people the wrong way. If you hold the R-390(*)/URR design sacred, then read no further. Get an original meter, or emulate it with external circuitry a la Jan Skirrow. I don't mind, it's a matter of personal taste and an attitude I sympathize with.

But the carrier meter circuit is a bad design. I REALLY get off on fixing bad designs. If you do too...

0. This mod assumes you have the original 100-ohm R523 zero adjust pot. Don't worry, the mod also fixes the problems with that pot that may have driven you to replace it.

1. Add a 1N914 or similar Si diode, with cathode grounded and anode connected to the junction of R544, R546, and R547;

2. Change R549 from 82K to 75K;

3. Change R548 from 27 ohms to 150 ohms;

4. On R523, cut the link between slider and clockwise end, leaving R524 connected to slider, and R537 and M102 connected to CW;

5. Change R537 from 22 ohms to 68 ohms;

6. Change R524 from 680 ohms to 620 ohms.

The circuit is now calibrated for a 100-ohm 1mA meter, and can handle lower-resistance meters by the simple expedient of adding a series resistor. Most meters with lower FS current (500uA, 50uA, etc) can also be used,

again adding series resistance depending on the meter.

7. Mark the deck or otherwise record the mod.
WISE/GITZEN 2007 M102 CARRIER METER MOD - CALIBRATED FOR
100 OHM 1MA METER. [Or whatever yours is.] TO OPERATE WITH
ORIGINAL METER, ADD 82 OHMS IN SERIES. [Or "CHANGE SERIES
RESISTOR TO 82 OHMS."]

Date: Wed, 29 Oct 2014 21:44:43 +0200
From: Grayson Evans <wa4gvm@gmail.com>
Subject: Re: [R-390] Panel meters again

Nice mod. I also agree with you on the carrier meter design. I would be very interested in the schematic if you still have it. I can come up with a circuit that will adapt almost any meter, so i don?t have a problem with that. My problem is mechanical. Trying to find a meter that fits the hole without having to enlarge it if possible. Thanks!, Grayson

Date: Wed, 29 Oct 2014 21:46:58 +0200
From: Grayson Evans <wa4gvm@gmail.com>
Subject: Re: [R-390] Panel meters again

Thanks for the link Barry, that meter looks like a good fit. Have to wait till they are back on line, worth buying a couple.

Date: Wed, 29 Oct 2014 21:57:34 +0200
From: Grayson Evans <wa4gvm@gmail.com>
Subject: Re: [R-390] Panel meters again

Thanks for chiming in Tisha. I remember the first time I discovered and bought a 390A back in the 1990?s. I was very impressed with the radio, but thought what is with the dinky meters? I can't even read the scale. I always thought the meters were the radios weak spot. Not quite in the same league as the rest of the receiver. However, they are understandable given the environment the radio was designed to work in and what was available at the time. You don?t want a lot of mass in the meter with the radio is subject to a lot of vibration.

When the radio is being restored, I think the meters need an upgrade. Something that matches the look of solid built, not something you would find on an inexpensive consumer electronics. Yet something with a scale that is larger and readable (and backlit).

Like I said, I can convert most meters to work, but I don?t want to rework the panel to take a larger meter hole if possible. I can move the screw holes if necessary. Anyway, the search is on.

Date: Wed, 29 Oct 2014 15:25:07 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Panel meters again

I think that if you are careful and pay attention to basic decon procedures you can remove the panel meters, take them apart and make new meter scales. Yes, the originals were painted with radium paint and I do not want to digress into that snake-pit. The reflector is filled with the 200 deadly effects of radium, the ways to avoid it, etc.. and that is a dead horse.

You could make a new bezel for the meter movement. Doing it again I would use a partially opaque plastic and a mylar film to print on a new legend. Then backlight the plastic with a white (or red, whatever) LED. It would look really professional. Maybe go with black lettering on a white background instead of smudgy, grainy white lettering on black. There are plenty of software apps out there to make your own meter scales.

I agree with you, I would not want to be hacking bigger holes in the front panel to put in a completely different meter.

Date: Wed, 29 Oct 2014 13:51:23 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Panel meters again

With more meters to choose from, you may find one that's also mechanically compatible. Here are the files; unfortunately they will get stripped at the mail reflector, so anybody else wants them, ask in a separate message. Hey Perrier, does this deserve to be a Tutorial at <http://www.r-390a.net/faq-refs.htm>
By the way, if you have meters but their faces are in bad shape, there are nice clean scans at the above URL.

Date: Fri, 31 Oct 2014 16:06:15 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] Panel meters again

>It was Jan Skirrow, and his mod is documented at his "Boatanchor
>Dreams" website

Note that the schematic in the article shows the op-amp with positive feedback. The connections to the + and - op-amp inputs should be swapped to make it a noninverting amplifier with voltage gain of 22. (That is, the 100k resistor should go from op-amp Pin 6 to Pin 2, not to Pin 3.)

Date: Sun, 24 May 2015 03:24:14 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: [R-390] R390A qvs vu meter mod 150 type 8 repair

I have the subject meter that is a little sticky, but works other than that. I'd like to repair it and looked in the pearls, y2k, and this forum for some assistance, but could not find any for a qvs inc meter. I'm having trouble disassembling it. I have the rubber ring off of the bezel ok, but it looks like there are 4 hollow rivets (1 in each corner). I tried unscrewing them and applied quite a bit of force, but no luck. I tried

pressing them out, but also with no luck. Has anyone opened one of these up. Can you give me some guidance, please?

Date: Sun, 24 May 2015 20:14:13 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] R390A qvs vu meter mod 150 type 8 repair

Thanks Don. ?Well that was a good idea, but to no avail. Any more ideas would be very helpful.

From: Don Heywood <wc4g@knology.net>
Hi Larry, I have not disassembled any QVS Inc. meters but I can tell you that the International meters have four slotted screws that are REVERSE threaded. You may carefully try that with your meters. 73, Don WC4G

Date: Sun, 24 May 2015 23:40:27 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] R390A qvs vu meter mod 150 type 8 repair

Hi Don, Sorry but I don't see the attachment. I have white meters in one of mine also, but they are not at all the real thing and I had to 'make' them work. I would like to see yours. Anyway, my meter needle is a little sticky and would like to try to fix it. The bezel also needs refinishing and its easier if it's off the meter. Here's links to pics of my meter in question:

http://s28.postimg.org/h5d7tqsyl/IMG_6757s.jpghttp://s28.postimg.org/54rrt0ljx/IMG_6760s.jpghttp://s28.postimg.org/mw3e7h0yl/IMG_6762s.jpghttp://s28.postimg.org/avhy6qtjx/IMG_6763s.jpg

It looks like rivets to me - what do you think?

From: Don Heywood <wc4g@knology.net>
Sent: Sunday, May 24, 2015 1:47 PM
Subject: Re: [R-390] R390A qvs vu meter mod 150 type 8 repair

Sorry Larry, the QVS meter is new to me. I have disassembled the Simpson, DeJur, & International. Does you meter screws have a slot for a screwdriver? I would try and noodle out how it was assembled and try to take it apart. BTW why are you taking it apart, is the glass foggy or do you want to make a new face. I have done that with Simpson meter faces. I have a couple of white faces, one is original and I made the carrier dial. I know how important it is to have the correct meters in your R-390. Attached is a receiver with white meter faces. Don

Date: Sun, 24 May 2015 17:02:43 -0700
From: Renee K6FSB <k6fsb.1@gmail.com>
Subject: Re: [R-390] R390A qvs vu meter mod 150 type 8 repair

I have had many makes apart and qvs is new to me too. Is it possible that they are press fit w/shouldered sleeves? pressed in from the rear? what does the other side look like?

Date: Mon, 25 May 2015 00:28:13 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] R390A qvs vu meter mod 150 type 8 repair

Well, let's try this:

http://s28.postimg.org/h5d7tqsyl/IMG_6757s.jpg
http://s15.postimg.org/x29k331yz/IMG_6760s.jpg
http://s29.postimg.org/fiqt47n0n/IMG_6762s.jpg
http://s11.postimg.org/wb62rl88z/IMG_6763s.jpg

I hope this is it! Thanks for patience.

Date: Sun, 24 May 2015 19:35:17 -0500
From: Francesco Ledda <frledda@att.net>
Subject: Re: [R-390] R390A qvs vu meter mod 150 type 8 repair

look like rivetted

Date: Sun, 24 May 2015 20:36:17 -0400
From: Roy Morgan <k1lky68@gmail.com>
Subject: Re: [R-390] R390A qvs vu meter mod 150 type 8 repair

My opinion: your meter is held together with tubular aluminum rivets. They are crimped/peened over at the front side.

You need to find a sharp drill that's a bit larger in diameter than the internal diameter of the hole in the rivet and carefully drill out the front peened-over part of the rivet. This will free up the rivet and leave a small ring that should fall out of the hole.

To get the meter apart, push out the rivets and gently pry between the rear of the bezel and the plate at the rear of the meter. You may have to go gently and start at one point and work your way around the circumference of the case. I expect you'll find a rubber gasket in there that will possibly stick to both the meter case flange and the rear surface of the bezel.

NOTE: It appears to me that your meter MAY have radioactive paint on the face and pointer. Do not be alarmed. Just don't lick the markings or needle. You may want to remove the meter face (likely held onto the movement with two screws) and carefully put it aside. Don't rub or clean the dial or pointer - just leave those parts unmolested and untouched.

THEN you will want to slide a bit of scotch tape down into the movement between the moving armature and the magnet pole pieced to dislodge any foreign matter that's causing the trouble,

For re-assembly, you COULD use epoxy to get it back to gather, but I suggest you simply mount the thing back on the radio without the rivets. If the flange of the case

sits below the rear edge of the bezel, put some shims in there to hold it away from the panel and ensure a good fit between the case flange, rubber gasket and bezel interior surface.

If you can't get it to run right, send it to Eldad.

Date: Mon, 4 Jan 2016 12:34:38 -0600
From: James Green <jagreen3@sbcglobal.net>
Subject: [R-390] What is inside R-390 meters?

I have a small collection of 100 milliammeters that have the same package as the R-390 meters. They are made by Simpson & look to be very high quality. I opened one up and removed the glass and dial. Inside is the movement with a wire-wound resistor (I assume) in parallel with the meter movement.

Question 1: What circuit(s) would be inside for the line level meter?

Question 2: What circuit(s) would be inside for the "S: meter?

Question 3: Is there some site I can download the artwork for silkscreening the dials?

Date: Mon, 4 Jan 2016 14:34:58 -0500 (EST)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] What is inside R-390 meters?

The wire-wound resistance in parallel with the meter movement is a shunt. The meter is designed such that a certain amount of current through the movement causes a full-scale reading. Without the shunt, something most likely much less than 100 mA would cause a full scale reading. At 100 mA, the shunt carries part of that current and the movement the rest. With a different shunt, the meter can be used to read a different full-scale value.

I don't know if original R390 meters have shunts (or series resistors). Aside from a possible shunt (or series resistor), I don't think there was any other circuitry in the original meters.

Date: Mon, 4 Jan 2016 14:42:58 -0800
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] What is inside R-390 meters?

The Carrier meter's terminal resistance is about 18 ohms. This is quite a bit lower than most 1mA meters. I would expect the original meter to not have a shunt, and also use relatively heavy wire in its moving coil. But shunt or no, any 18-ohm 1mA meter will drop into the circuit and work. (There are at least two different circuit mods out there that will permit use of arbitrary ammeters in place of the original.)

I haven't looked at the schematic for a while, but I expect the Line meter to contain a rectifier, because I don't think there's one external to the meter. It could also be a vane-type or dynamometer-type AC voltmeter, but I doubt it.

I have seen meter artwork scans, but I can't remember where. Try www.r-390a.net, and this mailing list archive.

Date: Mon, 4 Jan 2016 17:47:34 -0500 (EST)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] What is inside R-390 meters?

I didn't think of the possibility of a diode in the Line Level meter. I guess I flunked the test...

Date: Mon, 4 Jan 2016 15:09:49 -0800
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] What is inside R-390 meters?
Message-ID:

Might be a full-wave bridge (copper oxide or selenium stack), not just a single diode.

Date: Mon, 4 Jan 2016 18:18:05 -0500
From: Roy Morgan <k1lky68@gmail.com>
Subject: Re: [R-390] What is inside R-390 meters?

> I didn't think of the possibility of a diode in the Line Level meter. I guess I flunked the test?

No "flunking" allowed. Only to learn a bit and increase the stored lore! Yes, the line level meter is a rectifier type meter containing, presumably, a copper oxide full wave bridge type rectifier that is common in audio line level meters.

>> The Carrier meter's terminal resistance is about 18 ohms. This is quite a
>> bit lower than most 1mA meters.

Yes, and this is the challenge in trying to drop in any of the various same-size meters of different sort folks have come across and been hopeful about. Almost certainly any meter from some other use will have higher internal resistance, despite how urgently we all need affordable replacement meters of the same size and shape.

Note1: there is a "relatively" simple method to measure a meter's internal resistance with out putting it in danger from a normal ohm meter. (Establish a current source to produce full scale deflection from a high resistance, then parallel the meter with a variable resistor till it reads half scale, then remove and measure the paralleled resistor.)

Note2: "True" VU meters are much bigger, are made to rather exacting specifications established decades ago, and are seldom cheap. There is a good discussion at: www.aes.org/aeshc/pdf/mcknight_qa-on-the-svi-6.pdf which states that the volume indicator standard is continued in the 1990 IEC Standard 268-17. This and similar standards are hard to find free on the web,

because standards making organizations at least *hope* to recover development costs from sales of the standards. (They don't really, but seem to be ever hopeful.)

>> I haven't looked at the schematic for a while, but I expect the Line meter to
>> contain a rectifier,

Indeed it does.

>> because I don't think there's one external to the meter.

Right, there is not one.

>>It could also be a vane-type or dynamometer-type AC voltmeter, but I
>>doubt it.

Right again they are neither of those types. Most vane type and especially dynamometer AC meters are as big as two fists or bigger, and heavy.

>> I have seen meter artwork scans, but I can't remember where. Try
>> www.r-390a.net, and this mailing list archive.

I'm sure I have such artwork here, if anyone can't find it out there on the web.

Date: Mon, 4 Jan 2016 15:34:40 -0800
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] What is inside R-390 meters?

In 2007, Gary Gitzen and I came up with a Carrier circuit mod that allows retrofit with most 1mA meters. (It can also drive an 18-ohm unit should you find one later.) I think it's in the mailing list archive and the Pearls, but it did not make it into Y2K-R3. I have the write-up on my hard drive. Hey Perrier, you up for Revision 3B?

Date: Tue, 5 Jan 2016 09:23:05 -0600
From: Richard <prof1705@cableone.net>
Subject: Re: [R-390] What is inside R-390 meters?

This may help a little although targeted towards R390A.

Check <http://www.skirrow.org/Boatanchors/how%20to.htm> for
<http://skirrow.org/Boatanchors/TechTalk2.pdf> Adapting Surplus Meters for the R-390A

R390A meter faces are at <http://www.r-390a.net/faq-refs.htm>

The line level meter I fit into my radio used a DC meter movement and an external bridge rectifier with a repro scale.

Date: Thu, 7 Apr 2016 02:22:49 +0000 (UTC)
From: "R. David Eagle" <kb8nnu@yahoo.com>

Subject: [R-390] VU Meter Issue...newbie on first 390a

Hello all...Today was my first day of powering up my very first motorola 390a that I have been slowly working on over the last year.? I went through and checked all tubes with my tv7 and found a couple that needed to be replaced. Today was the day that the speaker finally got hooked up and the rig warmed up. Much to my surprise, I was copying cw on 40 after a few gleaming moments. One thing I noticed though, was my VU meter was not working what so ever and I have searched around for common fixes/problems but haven't turned anything up. Is there any common problems to look for outside of replacing the meter? Also...I noticed that the carrier meter has a film on the inside of it that is almost brown.? I am somewhat reluctant to pull it apart due to the whole radioactive particle scare, but are these easy to disassemble and clean?

Date: Wed, 6 Apr 2016 23:31:24 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] VU Meter Issue...newbie on first 390a

If you can disconnect the two wires going to the meter, measure the meter resistance. It should be around 7500 ohms. If it measures open, this is bad.... Maybe the internal rectifier have failed, or worse... A good R-390A VU meter should indicate 0VU when connected to an audio signal generator delivering 1Volt Peak at 1kHz.

Date: Thu, 7 Apr 2016 04:12:27 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] VU Meter Issue...newbie on first 390a

Hi David, ?Congratulations! ?Welcome to the group. For the VU mtr - have you checked the jumper on tb103 11 to 12? If yes, do you get audio on 10 and 13? If no, replace V604 and then V602. If yes, check for audio on the VU mtr terms. No need to disconnect it. As for cleaning the inside of our mtrs - some are easy to open and some are NOT. Just be careful with any possible dust from the inside - you don't want to breath it. A simple nose and mouth filter should be good, if concerned. If you're careful, you should not need one.

Date: Thu, 7 Apr 2016 04:17:46 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] VU Meter Issue...newbie on first 390a

Hi again David, Forgot another easy possibility for the VU mtr - check the 'line meter' switch contacts and the 'line gain' pot.

Date: Thu, 7 Apr 2016 23:39:46 +0000 (UTC)
From: "R. David Eagle" <kb8nnu@yahoo.com>
Subject: Re: [R-390] VU Meter Issue...newbie on first 390a

Thanks for the reply. I disconnected the one side of the meter and cheked the resistance and I get 419K one way then 240K the other.....it is somewhat

biased....Maybe the meter is shot?? :(

Date: Fri, 8 Apr 2016 03:11:22 +0000 (UTC)
From: "R. David Eagle" <kb8nnu@yahoo.com>
Subject: Re: [R-390] VU Meter Issue...newbie on first 390a

Thanks for the tip...I was going through these checks tonight as you suggested and a freak think happened to my upgraded sigma 3TF7 regulator replacement.. it shot blue arcs across the top of the IERC shield to the top of the regulator....game over. Back to tracking down more parts....I will recheck V604 and V602 with the TV-7 and see how they check out.

Date: Fri, 8 Apr 2016 03:28:35 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] VU Meter Issue...newbie on first 390a

Hi David, Bumberrrrrr! ?That's not good. I hope the 2 oscillator tubes are ok. I've had similar luck in the past, too. When I'm tinkering with these guys I like to put a 12BH7 or 12BY7 or similar tube in the regulator socket with the 2 wire change on the socket. Then when I'm done, I put whatever I want back in the socket. There's a whole bunch of tubes that have the right current for this purpose. If you don't have 1, I will send 1 to you.

Date: Fri, 8 Apr 2016 03:46:48 +0000 (UTC)
From: "R. David Eagle" <kb8nnu@yahoo.com>
Subject: Re: [R-390] VU Meter Issue...newbie on first 390a

I appreciate the offer....I am going to see what I have laying around. I guess this begs the question of whether a solid state replacement is worth it or should I stick to the original regulator. This may open up the doors for a lengthy debate, BUT I am learning a lot from this rig and I can't wait for the day to finally slide it in the case on the desk!

Date: Fri, 8 Apr 2016 10:10:22 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] VU Meter Issue...newbie on first 390a

They were reputed to lit when they were new.
I never see it for myself, however !

Date: Sat, 20 Aug 2016 01:27:32 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] R390A qvs vu meter mod 150 type 8 repair - Complete

I finally got to work on this meter a little bit. Thanks Roy, Don, Renee, Francesco and Tisha for your suggestions. I borrowed a drill press and drilled (what I hoped and believed were rivets) out a little. Thanks for the suggestion to use the press.

Here's the links to the pictures I posted of it before, untouched, on May 23, 2015

8:24 PM:

http://s28.postimg.org/h5d7tqsyl/IMG_6757s.jpg
http://s15.postimg.org/x29k331yz/IMG_6760s.jpg
http://s29.postimg.org/fiqt47n0n/IMG_6762s.jpg
http://s11.postimg.org/wb62rl88z/IMG_6763s.jpg

After I drilled one, I could easily see that they were rivets. Here's the link to the picture after drilling:

https://s3.postimg.org/nn15sx1pv/IMG_7264s.jpg
https://s4.postimg.org/kc30jownh/IMG_7266s.jpg

I then wrapped the body with masking tape (about 6 layers) to use as a prying fulcrum in order to get the face off. That worked great. It was stuck on with a weak rigid adhesive, which allowed the face to be pried off with a little careful pressure with a screw driver between the tape and face. I then removed most of the adhesive around the glass. It came off very easily. The glass was still adhering to the meter body, so I carefully inserted a thin knife blade between the glass and body and carefully worked it around the circumference to free the glass. Here's links to pictures showing tape, bezel off and removal of the glass:

https://s3.postimg.org/nn15sx1pv/IMG_7264s.jpg
https://s4.postimg.org/5idos2lil/IMG_7268s.jpg
https://s3.postimg.org/ib8snr6dv/IMG_7270s.jpg

After a little examination and manual moving of the needle, it was easy to see that the top coiled control hair spring was not in the correct position. The outer ring was coming in contact with the next ring, causing it to stick in different places on the low db side. After careful manipulation, I managed to get it good again. I've been testing it with audio from my 390A for a few days, and it's working great. Sorry I could not get a picture of the spring, but here it is cleaned up, painted and put back together:

https://s4.postimg.org/nybudkft/IMG_7276s.jpg
https://s4.postimg.org/g43q8bkjx/IMG_7273s.jpg

I glued the glass back on with a very very small amount of flexible glue and the same with the bezel. I applied it with a tooth pick to control the amount. One thing to be careful of is putting the glass in the right side down. The edge of the glass is NOT flat and will only seat correctly one way. If it's put in backwards, the body will not seat correctly into the face plate. I suspect that if too much pressure is applied with the glass in the wrong way, it will break.

I'm really puzzled as to how the movement spring got damaged, because from all of the signs when I took it apart, I'm the first one to do so. I did buy this from an individual, so who knows how it was handled before me. But, the packaging was excellent when it was sent to me.

Date: Sat, 20 Aug 2016 11:20:35 -0400
From: Guido Santacana <gsantacana@gmail.com>
Subject: Re: [R-390] R390A qvs vu meter mod 150 type 8 repair - Complete

Super excellent job on the meter Larry. Thanks for sharing those images. I may go on that pathway if my carrier level meter continues to stick at 60dB.

Date: Wed, 24 Aug 2016 04:37:39 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: [R-390] R-390A Line Meter Calibration

I tested the accuracy of my line meters a few years ago with my HP 400FL and determined that one was reading 1 db low. Not a big deal, but I decided to 'adjust' it, so I wouldn't have to keep mentally compensating for it. Before I did this last rash of measuring, I simply added a 25k compensating resistor across R110. It was easy to do without removing the front panel. The two attachment points shown in the pictures are pretty easy to get at.

https://s14.postimg.org/eadf362bl/IMG_7279s.jpg
https://s13.postimg.org/i3oq2mo6f/IMG_7282s.jpg

Date: Thu, 15 Dec 2016 22:24:03 -0800
From: "Chris Kepus" <ckepus@comcast.net>
Subject: [R-390] R-390A meter substitutes, repair, or sales.

I am rebuilding a R-390A and am in the process of gathering parts while my back recovers from lumbar fusions and other restorative surgical procedures. I have another 90 days before I'll be maneuvering this R-390A onto a repair bench. This R-390A is missing it's meters so I am looking for either the real deals or suitable substitutes. If anyone has spare working meters that they would like to convert to wampum, please contact me directly.

Given the relatively scarcity of these rascals, I have found at least one candidate for a substitute meter. It has the same dimensions as the original meters and when flipped over, it appears to have the same circular "nut" with four equally spaced square notches and the "nut" is recessed into the Bakelite surrounding the circular meter case. I have never attempted to take one of these meters apart so would someone who has performed meter surgery please enlighten me if it possible to open these meters up. The circular "nut" may not be a nut at all.. But if it is, it looks like it requires a unique spanner wrench.or ? Thanks in advance for any and all input, suggestions, sad tales of meter destruction, or success stories.

Date: Fri, 16 Dec 2016 08:19:02 -0500
From: "Bill Riches" <bill.riches@verizon.net>
Subject: Re: [R-390] R-390A meter substitutes, repair, or sales.

Look on Ebay - there are usually meters there. Contact the seller and you may be able to get a matched set.

Date: Fri, 16 Dec 2016 07:34:20 -0800
From: "Chris Kepus" <ckepus@comcast.net>
Subject: Re: [R-390] R-390A meter substitutes, repair, or sales.

Thanks for your response, Bill. I've got my eye on a couple of eBay meter prospects but one tends to have greater trust in a known group, hence my ask about possible spare meters here. I also acquired a meter that is physically the same size and configuration but has a white meter face and, of course, the wrong scale, which is why I am hoping someone will come back with info on how to disassemble these meters, if possible.

Date: Fri, 16 Dec 2016 14:09:50 -0500
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] R-390A meter substitutes, repair, or sales.

Your problem is twofold:

- 1_ How to make "found" meters resemble the original ones (involves disassembly/reassembly and change of scales).
- 2_ how to "fit" those in the R-390A circuitry.

The original R-390/R-390A meters are not really "standard". The Carrier Level meter especially, have quite unusual ratings: $F_s = 1\text{mA}$, $R_m = 17.6\ \text{ohms}$ (means a full deflection for 17.6mV across, which denotes a very sensitive meter - large magnetic field value there). 1mA full scale meters can be easily found (well, have been easily found) but none of those I run across since the mid-80s were having less than a 50 ohms R_m , and more currently more (up to 200 ohms). This means that even if the original meter scale can be replicated and fitted to one of those "found" meters (which is relatively easy, actually), they will not perform as intended in the R-390A unless parts values in the Carrier Level circuitry are modified, OR, if an active "meter adapter" (using an operational amplifier) is added to the radio.

Another meter rating which was easily found is $F_s = 100\ \mu\text{A}$, $R_m = 1100\ \text{ohms}$ (means full deflection for 110mV across, so far from the OEM Carrier Meter value again, but at least this one can be used in the VU Meter position. "OVU" being 1.228V (+4dBm in 600 ohms) and the normalized VU meter impedance being 7500 ohms, it means that at a +3 VU reading, it needs 232mA passing thru. So a 100uA, 1100 ohms meter will be OK, giving some adaptation (rectifier bridge needed, calibration of the full scale and of the total impedance, etc). The point is that it will be impossible to use a 1mA meter in the VU position without external amplification/adaptation.

Meter disassembly now: I suspect the meter you describe to be of the "Cosmos Industries" type. But just to be sure, can you provide me with a picture of the front and back of your meter, please? These are not too much of a problem to open/reassemble (less than some hermetically sealed/soldered ones, say...).

And yes, I have a R-390A on which the meters were missing...

Date: Fri, 16 Dec 2016 15:22:28 -0600
From: Tom Frobase <tfrobase@gmail.com>
Subject: Re: [R-390] R-390A meter substitutes, repair, or sales.

I have a back burner project I have been working on. I have multiple 390's lacking meters, I thought about a solution for a good while and decided to go digital, although it will emulate an analog meter. Attached is a picture of my prototype. <http://www.kitparts.com/r-390/meter.jpg>

One of my fellow ham's worked with me to produce a meter housing to fit a 64 X 128 pixel OLED display. What you see here is the raw printed plastic, no paint. It is the same physical size as the original meter. The unit will be powered off of power borrowed from the pilot lamp. Since the a/d converter will be used the resistance will be identical to the original. The audio meter will do the ac - cd conversion internally. Thought I might add a digital DB field under the meter. Lot's of available options but first I just want the holes filled ...

Date: Fri, 16 Dec 2016 16:40:35 -0500
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] R-390A meter substitutes, repair, or sales.

Back in August, Larry posted comments about opening a line level meter, with links to photos he took along the way and a detailed description of the process:

<<http://mailman.qth.net/pipermail/r-390/2016-August/056145.html>>

You can find an article about using 1mA FS meters with higher resistance here:

<<http://www.qsl.net/kh6grt/page4/R390meters/meters.htm>>

This requires adding a meter amplifier. Schematic here:

<<http://www.qsl.net/kh6grt/page4/R390meters/CarrierMeterAmp.pdf>>

NOTE: The LT1012 and OP97 opamps are improved functional replacements for the obsolete LM308, but their overcomp capacitor uses Pin 5, rather than Pin 8 (as the LM308 uses). The appropriate overcomp capacitor value could be different, as well (but it is extremely non-critical).

Date: Fri, 16 Dec 2016 15:40:44 -0600
From: Tom Frobase <tfrobase@gmail.com>
Subject: Re: [R-390] R-390A meter substitutes, repair, or sales.

Yes Jim that is the plan, to look as much like an analog meter as I can. Working on the software I realized that I can make the arc a little longer

and larger since the mechanical movement for the meter pivot is not a limitation anymore.

Date: Fri, 16 Dec 2016 13:58:01 -0800
From: "Chris Kepus" <ckepus@comcast.net>
Subject: Re: [R-390] R-390A meter substitutes, repair, or sales.

Hello Jacques and many thanks for your helpful message. The meter I purchased and would like you to check out the pictures posted with it is eBay item 272446948312.

The one picture I would like you to take a hard look at is the picture that shows the rear of the meter and what I previously described as a circular "nut" with four equally spaced square notches. The "nut" is recessed into the Bakelite surrounding the circular meter case. I am looking for confirmation (or not) if this "nut" is the key to open up the meter. Also am very interested in getting a very "nuts and bolts" specific description of the technique and tool used to remove the "nut". I'm looking forward to your response.

Date: Fri, 16 Dec 2016 22:13:46 +0000 (UTC)
From: John Flood <kb1fqg@yahoo.com>
Subject: Re: [R-390] R-390A meter substitutes, repair, or sales.

I may not have seen the whole thread here but please keep in mind that many of those meters have radium on the face and even if it isn't glowing anymore, its still hot in the terms of radiation and that is not something you want to ingest.

Date: Fri, 16 Dec 2016 16:24:37 -0600
From: Lee <L@w0vt.us>
Subject: Re: [R-390] R-390A meter substitutes, repair, or sales.

Yes, the radium is not dangerous unless you open the meter. Not a good idea to do so.

Date: Fri, 16 Dec 2016 18:37:17 -0500
From: Glenn Scott <wa4aos@aol.com>
Subject: [R-390] Toms meter replacement

Some people are purist and want to keep their receiver as stock as possible but I believe many of us would welcome a more modern digital meter, assuming, you are able to get them to look much like the original meters.
If you get this project going, I would like to talk to you about using them in some of my restoration work.. More about this offline and at your convenience.
Great project..

Date: Fri, 16 Dec 2016 23:41:36 -0800
From: "Chris Kepus" <ckepus@comcast.net>
Subject: Re: [R-390] R-390A meter substitutes, repair, or sales.

Yep, I've read the mail over the years when the discussion turns to our 'hot' meters. I likely will not be digging into stock meters unless they don't work. The meters I will have to dig into will be any subs on which I will want to change the meter scales.

Date: Tue, 27 Dec 2016 21:27:39 -0400
From: Guido Santacana <gsantacana@gmail.com>
Subject: [R-390] Stuck Meter

The carrier level meter in my recently resuscitated R390A is sticking at 60 and will not pass this mark. I have to tap the meter to get it back to work when it sticks due to very strong signal. Any recommendations apart from opening the meter or getting a "new" one?

Date: Tue, 27 Dec 2016 21:05:03 -0500
From: Roy Morgan <k1lky68@gmail.com>
Subject: Re: [R-390] Stuck Meter

If it were my meter, I might well take it apart and try to get the teensy bit of crud out which is causing the sticking. HOWEVER, some will warn violently about the dangers of radioactive materials. It's pretty easy to tell if a meter has that stuff in it or not. If it does, you may want to leave it alone. My advice about the meters that DO have radioactive material in them is:

Don't break them open and eat the insides.
A fellow known to do good work on meters is:

Eldad Benary
The Sound Company
129 George Sickle Road,
Saugerties, NY 12477
845-246-2466
eldad at hvc.rr.com "Eldad" <Eldad@HVC.RR.com>

He certainly can fix the thing, and that might be faster and easier than trying to find a replacement

Date: Wed, 28 Dec 2016 04:15:30 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] Stuck Meter

Hi Guido, If you are good at working on small fragile things, then it might be worth it to try it. I have successfully repaired a few and also broken some, so you need to be the judge. As Roy mentioned, if it's a radioactive meter, you need to be careful not to inhale any dust from its inners or get it in your eyes. Don't lick your fingers while working on them. It's not difficult to work on them and be safe. Use logical care. Wash your hands when done. There are a dozen manufactures, so opening them up can be easy or difficult, depending on their method of sealing. Sometimes that's the most difficult part. If you're not sure about opening it up, post a picture here.

Date: Wed, 28 Dec 2016 13:58:07 -0500
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] Stuck Meter

Aren't all original 390 and 390A meters radioactive? Does anyone have a documented case of an original 390 or 390A meter that is NOT radioactive? (I realize that the OP didn't state whether his radio has original meters or not, so the previous replies saying "IF it is a radioactive meter..." may have been contemplating the possibility that his radio has replacement meters that are non-radioactive, not necessarily original meters that are non-radioactive.)

Finally, to the OP: No, I don't believe there is anything you can do to fix it without opening it up. There may or may not be anything you can do with it open. One thing NOT to do if you open it is to conclude that the pivot bearings need to be adjusted. In my experience, that is NEVER the problem (unless someone has been there before you and done it already), and you could make things much worse if you play with them. If you get them too loose, the armature may slip out of the bearings and you've screwed the pooch.

The problem is almost always the pointer touching the scale or the glass, or "crap in the gap" -- iron filings that find their way into the magnet gap and are held there by magnetic force, or other crud. You need to look into the gap very carefully with a high-powered magnifier, and remove anything you find with NON-MAGNETIC implements. I have used toothpicks, plastic dental picks, and tape successfully.

Date: Wed, 28 Dec 2016 18:38:55 -0400
From: Guido Santacana <gsantacana@gmail.com>
Subject: Re: [R-390] Stuck Meter

The meters are original. At some point I read a post stating that that some original meters were radium painted and others not. I have always treated them as radium painted and will consider this one as such. Better safe than sorry. In some of my other radios I have worked on the meters with some luck except in one case where I inadvertently disconnected one of those micro wires. One of my former R390s had a loose meter glass that I was able to carefully glue back in place without meter disassembly using a bit of cyanoacrylate and something to hold the glass in place from the outside.

This particular meter probably has some junk in the gap. The pointer looks free. Only once did I mess with the pivot bearings in a meter. It was that of the SX28 and it was done with fingers crossed but the problem was fixed. So, I will prepare for the delicate surgical procedure in accordance with the greatly appreciated recommendations from all of you and will report back with results. The line level meter is fine but I never use it. IN 1979 when I got my first repairable R390A from Fair, NOS meters were easy to come by. Now they are almost unobtainium.

Date: Sat, 31 Dec 2016 15:08:03 -0600

From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] [OT] Radioactive radio parts

Many years ago I was a FEMA certified "Radiological Instructor III" (I could teach other instructors). For an EMA organization I was teaching a course "Radiological Response Technician (RRT), a three day course. What was included in the course was an exercise to map an area where there were hot spots of radiation. I was using Cobalt 60 check-sources (FEMA provided capsules in a big lead storage pig).

I would use the pair of long tongs to grab a source by its tag and hide it in clever spots in a room (the EOC). The students would enter the room as teams and had a few minutes to make a map of where the sources were located. Not all were on the floor, some were up high (one over a ceiling tile), some were directive (installed in a shielded cup so the radiation was not omni-directional. For me it was all quite fun and the students learned allot.

I sent in this one team, actually a husband-wife team who worked at a national laboratory (Argonne) and were very smart and capable. They spent a few minutes in the room, got out quickly and wrote me a map. They showed "five sources". It was interesting because I only put four sources in the room so I looked at their map. They found a source where I had not put one. Going back in the room with this team I used my meter, a much better Ludlum meter with a pancake frisker probe than their simple yellow Civil Defense wand type GM tube detectors. Sure enough, a fifth source. It was inside of a wooden cabinet, in there was an old WWII HF receiver. The radiation was coming from the white filler paint on the face of the radio. Even though the radio would not glow any more there was enough radium salts in the filled front panel to put off around 1 mR/hr at a distance of six inches. The radioactive paint on the radio was not behind glass, like on our panel meters. I could see where some of the lettering had flaked off over the years but most was still there.

The radium used to paint meters and glowing lettering was not quite pure. It is a radium salt that is contaminated with other isotopes so it puts out gamma, beta and alpha radiation. Its primary hazard is inhalation and ingestion of the dried, powdered form. The radiation is a few mR/hr and for a limited exposure of an hour or so you are not even approaching reporting limits.

You can work on a panel meter and as long as you follow some basic precautions you will be fine. Wear a dust mask, latex surgical gloves and work in an area that you can wash down when you are finished (preferably not your kitchen table).

Put down a piece of kraft paper or something else that you can wad up and throw away when you are done.

If you do go so far as to take a panel meter apart and want to keep th same lettering on the meter just use a piece of clear packing tape to put down a single layer of tape across the front of the meter, trim the edges to fit. Then as long as you do not

peel the tape off there is no risk of gross contamination from loose materials.

When you are finished, clean up the surfaces with hot soapy water, wipe down your tools screwdriver tips, etc, throw away the dust mask and if it makes you feel better, take a shower to remove any surface contamination.

To put things in perspective, here is a comparison;

If you do a cross-country flight (of the US) where the plane spends most of its time up around 30,000 feet you are being exposed to about 1 mR/hr of gamma and 2 mR/hr of neutron radiation (due to cosmic rays and that you are above the majority of the atmosphere that attenuates cosmic rays from the sun and space).

When I was an instructor I had to carry a TLD (crystal based dosimeter) and had to track all the times I had the lead pig open with the check sources out, when I was doing classes and when I was exposed to higher levels of radiation. Every few months I mailed my TLD back to the state and they did an analysis to determine my accumulated dosage. Now I would also need to track the number of times I would go on a flight and the number of times I would go through airport screening near the X-ray machine or the walk through scanner.

A few years ago I came down with thyroid cancer (as an infant we lived in an area that received a few dustings from nuclear testing in the southwest). To treat my thyroid cancer I opted for radioactive Iodine 131 treatment instead of surgery. As a self experiment I tracked my own exposure to my thyroid every day for a month. My accumulated thyroid dosage was externally measured at around 350 REM. The internal dose to my thyroid was probably ten times higher because it killed off my thyroid entirely; Iodine accumulates in the thyroid but still I also had a whole body dosage of a few REM and was not supposed to spend much time around people, particularly children.

You taking apart your panel meter and working on it for an hour or so might give you more of an exposure. Particularly on your fingers where the surface dosage may be hundreds of mR/hr (remember, radiation follows the same rule as RF energy where it is distance dependent).

In college I interned at a couple of national laboratories. In one facility there was a labyrinth of tunnels beneath our building (radiation sciences) and in all of these concrete areas were places where the wall or floor had been painted with a patch of thick white paint and then a date, serial number and radiation level was written on the white paint.

Those were places where they had some experiment that splashed, spilled or sprayed on the walls and they could not get it completely clean. They sealed it in with lead-based paint and documented where it was and what the level was. I was told that once or twice a year someone would go back in to the basement and check those areas again, mostly to make sure that the paint had not peeled off, exposing the loose radioactive material.

A creepy thing was in the basement. They had a wooden display case covered with glass that had human bones inside of it. They were samples from the watch face painters who applied radium to dials (and presumably our radios). To put down the finest lines they would "tip" their paint brushes on their tongues, inadvertently eating a bit of radium each time. Many died prematurely of leukemia and cancer and somehow the government gained samples of their skeletons. To this day those bones are radioactive (radium is a bone-seeker, it accumulates like calcium).

Great article on it:<http://www.medicalbag.com/profile-in-rare-diseases/the-radium-girls/article/472385/>

Ok, enough of my Off Topic (even though it lead (or is it lead?) back to the original topic of radioactive panel meters.

Date: Sun, 10 Jun 2018 17:40:48 -0400

From: Bob Weiss <bobweiss1967@gmail.com>

Subject: [R-390] Another R-390A back among the living, and de-nuclearized....

<snip> In addition to replacing all the paper and electrolytic caps, I installed a GFCI-compatible AC line filter, solid-stated the power supply, added inrush limiting, and swapped out the selenium rectifier for silicon. Unit works great, and will go through one final iteration of the complete alignment before installing into a rack in the operating location.

Another upgrade was the replacement of the infamous radioactive panel meters. A check with a Geiger counter (Ludlow, with 2" pancake tube) showed nearly 10,000 CPM at the (completely intact) meter face, and much of that was gamma, verified by shielding the probe with a sheet of aluminum with little effect. Figuring that having a couple unnecessary gamma sources a few feet from my head when sitting at my bench certainly wasn't helpful in any way, I decided to go for the ALARA approach, and seek replacement meters.

I lucked into ma nice matched pair of DeJur VU meters on eBay, which were exact mechanical replacements for the DeJur meters that were originally installed. The meter faces were marked as "Electro Ind. Corp.", who apparently made magnetic tape recording gear at one point.

Replacing the line level meter was a simple matter of connecting the new and old meters to an audio generator, and checking the sensitivity of the new meter against the original. The new meter was quite a bit more sensitive, but adding a resistor of around 950 ohms in series produced a reading that perfectly tracked the original across the whole range.

Of course, the carrier level meter was a bit trickier to replace. I began by

carefully opening the other VU meter, and removing the internal copper oxide rectifier bridge and resistor, ending up with a DC meter with around 1.5k resistance, and 250 uA full scale sensitivity. I also removed the scale card from the meter, and scanned it into MS paint 3D, where I reworked the scale into an S-meter, rather than the simple 0-100 scale of the original 390 meter.

Digging around online, I came across KH6GRT's design for an opamp circuit for adapting common meters to the R-390 bridge circuit. I decided to update his design somewhat, eliminating the long-obsolete LM308N in favor of an Analog Devices OPO7, and building the entire circuit using SMD components to save space. The board fits nicely right on the back of the meter, with plenty of clearance from the cam gears behind it. Powered from the dial lamp supply, it was tested against the original meter and adjusted to 1 mA full scale using an external current source. It tracked nicely against the original across the scale.

The replacement meters with white faces and black/red lettering look much nicer and are easier to read than the black-faced originals, IMO.

Pictures of the installed meters and the amplifier PCB available at:
<https://www.flickr.com/photos/140826987@NO7/>

If anyone on this list is interested, I had a couple extra PCBs made, and would be willing to sell them at \$20 each (fully assembled, just add meter and one resistor) to anyone who wants one. Done by OSHPark, they have a dark purple soldermask that hides well inside the radio, without drawing much attention to the somewhat heretical sand-state parts attached to it.

As to the original pair of meters, they are fully functional, and available free to anyone on the list who wants them, and is willing to be a careful steward of them going forward and keep them out of a landfill or other improper disposal. The only catch is that I am not willing to mail them, as radioactive materials are banned according to 2 separate PO clerks, and I'm not willing to see what happens if I mailed one and it happened to trip a radiation detector somewhere in shipping. They would need to be picked up in Northern NJ. Contact me off-list if interested in adopting them, before I consign them to hazmat disposal.

Date: Sun, 10 Jun 2018 22:13:08 -0400
From: W2xj <W2xj@w2xj.net>
Subject: Re: [R-390] Another R-390A back among the living, and de-nuclearized....

The real original meters were radium and were replaced with non radioactive meters while in service. If you come across original meters, the face has green markings and glows in the dark.

Date: Sun, 10 Jun 2018 22:13:08 -0400
From: W2xj <W2xj@w2xj.net>
Subject: Re: [R-390] Another R-390A back among the living, and
de-nuclearized....

The real original meters were radium and were replaced with non radioactive meters while in service. If you come across original meters, the face has green markings and glows in the dark.

Date: Mon, 11 Jun 2018 18:56:21 -0500
From: Dave Merrill <r390a.urr@gmail.com>
Subject: Re: [R-390] R390A meters

I have two 67 contract EACs and both have non-radioactive meters, verified with a Ludlum Model 2 Survey Meter. The Carrier meters are marked 59.7289 and the Line Level meters are marked 59.7290. All these meters glow bright green when exposed to a UV source.

I also have an older R-390A and both meters have had the Ionizing Radiation Symbol sticker applied. The Ludlum goes nuts when brought close to the glass on these.

Date: Mon, 11 Jun 2018 20:03:05 -0400
From: W2xj <W2xj@w2xj.net>
Subject: Re: [R-390] R390A meters

The military at some point started replacing Radium meters as the radios came in for maintenance and new contracts were built with the Radium free meters.

Date: Tue, 12 Jun 2018 01:17:40 +0000 (UTC)
From: "Tom M." <courir26@yahoo.com>
Subject: Re: [R-390] R390A meters

The latest meters I encountered were made by A&M for ex NSN (audio meter) 6625-01-127-4037, 1989 date code. Not sure if they had radium.

Date: Wed, 13 Jun 2018 21:17:12 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] R390A meters

Several people have contacted me offlist asking how much risk there is if one *does* open a radioluminescent 390/390A meter. This is a very tough question. My answer is: I know nothing about you, or your abilities concerning careful detail work that requires fine dexterity and hand-eye coordination, or your ability and willingness to follow instructions down to the last detail. Therefore, I must recommend that you *DO NOT* open a radioluminescent 390/A meter *for any reason* .

If you decide to ignore this advice and *do* open such a meter, you must absolutely, positively insure that you are the only person who could possibly be exposed or endangered by your activities. I also recommend that you *study* (not just "review") the AEC/NRC cleanup protocols, as well as the standards and protocols that govern working with materials that contain Ra226. You will also need to ensure that you have laboratory-grade radiation monitors (\$\$\$) available at all times.

At a minimum, you will need an indoor space that is relatively well sealed (doesn't exchange air with the outside environment). You will need to enter this space and seal it up, and have available at least one laboratory-grade radiation monitor (preferably two, for sanity checks).

You will also need to have a reliable communications device you can use to contact your local HAZMAT authority, as well as the contact information for that authority. This means that no part of any dwelling occupied by others may be used (whether they are there at the time or not). *Period*. You at least need a standalone building (preferably small) located at least 50m from the nearest other building.

So, the drill is: Seal yourself in and do your work, continuously checking the radiation monitors. Clean up, putting all leftover radioactive materials into radiation-safe containers that are shielded for the types of radiation emitted by the item(s) you were working on (alpha, beta, and gamma in the case of Ra226). Check for residual radiation *everywhere* in the space you are working in, including your own person and clothing. Check again. Check a third time.

If everything tests clean, arrange to have your local HAZMAT authority pick up the waste container(s) (or transport it to them, if permitted in your jurisdiction -- but be sure to *CALL FIRST* to alert them that you will be coming). Now, here is the hard part. If there is any residual radiation, *STOP* before you spread it any further. Call your HAZMAT authority, explain the situation to them, sit down calmly, do not move or stir the air, and wait patiently for the nice people in radiation suits to come and decontaminate you and your space.

Now, do you still want to open up your meter. If so, (1) keep your eyes wide open, (2) take full responsibility for what you are doing, understanding that radioactive dust is easy to spread and virtually impossible to collect after it is spread, and (3) take all of the precautions described above. I have done this in the past, but I would not do so today because my manual dexterity may no longer be up to the challenge due to aging.

Better, look at *how nice* Bob's replacement meters came out, and follow his lead.

Date: Wed, 13 Jun 2018 22:20:12 -0400
From: "Robert Meadows" <rpmeadow@bellsouth.net>

Subject: Re: [R-390] R390A meters

In my past, dealing with WWII vintage aircraft instruments, it was always best choice to send the instruments to a certified overhaul shop where the instrument dial/face would be properly removed, the instrument services/overhauled as necessary and a new dial/face installed that didn't have any radium in it. In my locality, there is a Govt facility that processed such instruments for disposal/sale, utilizing sailors in many cases to remove the instruments from their packing boxes, (the cardboard was worth money). The instruments were "placed in a hopper". Well sailors being sailors, many were broken. The radium still resides in the surrounding waterways and a "closed" swamp, according to the officials in charge of the cleanup... go figure. Even the early Big Ben alarm clocks are full of that magic glow in the dark dial powered by radium. The phosphor eventually burns out, but, the radium will be around for a long time. Why not just leave the meters alone and don't f... with them. Madame Curie learned the lesson the hard way.

Date: Wed, 13 Jun 2018 22:47:12 -0400
From: W2xj <W2xj@w2xj.net>
Subject: Re: [R-390] R390A meters

I prefer the radium meters but realize that it is a strong indicator that the radio never went through maintenance so the radios with replacement meters are likely in better shape. About 25 years ago I had 3 R390's, two had radium meters. I've worked with R390s radios over 50 years, often close up for long periods of time. My worst health issue is the aftermath of a severely broken ankle due to overly intense activity.

Date: Thu, 14 Jun 2018 15:15:55 +0000 (UTC)
From: Mike Bracey <mikebracey@att.net>
Subject: Re: [R-390] R390A meters

Ha, exactly what I was thinking.

Date: Thu, 14 Jun 2018 16:55:17 +0000
From: Larry Zefers <zefers@msn.com>
Subject: Re: [R-390] R390A meters

I agree with Mr. Bracey totally. Being involved in nuclear clean up teams and instrument calibration of these devices you should stay away from any exposure to radiation of nuclear sources as he describes. We have all been exposed to this type of radiation on one level or another and as time goes on we may be exposed to even more. So beware and advised your health is most important. Protect yourself at all costs.

Date: Thu, 14 Jun 2018 18:50:28 -0400
From: Bob Weiss <bobweiss1967@gmail.com>
Subject: [R-390] Carrier meter PCBs available.

I have had a few folks contact me about the carrier meter amp PCBs I made for my 390A restoration. The remaining units quickly sold, so I had an additional run of the boards made, and am still offering them at \$20 per board, plus \$5 shipping in US.

This is a 1.5" diameter round PCB which allows a standard high resistance meter to work and achieve proper deflection with the unusually low impedance requirement of the 390 meter bridge circuit. It uses an operational amplifier as a current sense amplifier, with a 18 ohm shunt resistor to duplicate the original meter resistance. Requires 2 additional wires to power the amplifier, connected to the AC heater supply and ground. Board comes completely assembled and tested, you supply the meter (practically any low range DC milliammeter-microammeter), and you will need to select and install a calibration resistor for it. Installation instructions and schematic included. Picture of the board available at:

<https://www.flickr.com/photos/140826987@N07/>

Payment via paypal, or snail mail to QRZ address.

Date: Sun, 24 Feb 2019 10:28:36 -0500
From: "Don Heywood" <wc4g@knology.net>
Subject: Re: [R-390] 1 R-390 Meter Kit for sale

Don, I have found in some of the International Meters those four housing face screws mentioned in the first paragraph are REVERSE threaded, be cautious.

Date: Mon, 25 Feb 2019 01:09:04 +0000 (UTC)
From: "R. David Eagle" <kb8nnu@yahoo.com>
Subject: [R-390] Line Level Meter not working...Help a newbie!

I have just started back up restoring my Motorola 390a after taking a break from it after moving to a new QTH. I have gone through it pretty well and re-tubed it and deoxed what I could. The receiver seems to receive good, but I noticed that my line level meter doesn't move a bit. The carrier meter seems to function OK with received signals. Is there a good way to test the meter or is there something else I can check in to? Might be looking for a replacement..? Thanks in advance for the help!

Date: Sun, 24 Feb 2019 21:35:19 -0500
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: [R-390] TR: Line Level Meter not working...Help a newbie!

Dave, check if the line audio output jumper is there: TB103, pins 11 and 12. If there is no jumper populated, no reading from the line level meter is possible.

Date: Sun, 24 Feb 2019 20:50:38 -0800
From: Larry H <larry41gm@gmail.com>
Subject: Re: [R-390] Line Level Meter not working...Help a newbie!

Hi David, Jacques is right and that is probably it. But, if not, the meter might be stuck - try tapping on the face. Or try turning the line gain up to 5 or 6 and the line meter switch to 0 or -10 (try exercising this switch a little, also). Then try hooking up 600 ohm phones, AC meter, or speaker to line out on the back. If nothing there, try swapping the 6AK6 outputs v603 and v604. If still nothing, try a different 5814 at v602.

Date: Mon, 25 Feb 2019 19:39:14 +0000 (UTC)
From: "R. David Eagle" <kb8nnu@yahoo.com>
Subject: Re: [R-390] Line Level Meter not working...Help a newbie!

Hi Larry. Thanks for the tips. I put 2 new 6AK6's in that tested strong and the same for 5814. Still no movement. I hooked my meter up to the meter terminals while listening to an local AM station and it appears to be deflecting as it should with a small AC signal. I checked the movement and it is moving freely. So I am betting the meter must be shot.

Date: Mon, 25 Feb 2019 13:34:19 -0800
From: Larry H <larry41gm@gmail.com>
Subject: Re: [R-390] Line Level Meter not working...Help a newbie!

Ya, it looks like it. Bummer!!! I'm sure someone on the forum has a spare, so you could put out a request for one. Sorry, I do not.

Date: Mon, 25 Feb 2019 22:58:28 +0000 (UTC)
From: Roger Ruskowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] Line Level Meter not working...Help a newbie!

Dave, swipe your ohm meter probes across the line level meter terminals and watch the line meter movement. If it twitches it is good. If you break your R390 meter movement through an improper test event you will have a life time learning experience. A good cal and BFO mix should drive the meter to zero if not full scale. Over the top inspection and correction has not fixed this problem for you. A popular mod it to rewire the local audio output by passing the meter circuit. The 600 ohm balanced line output around 0 Vu If you diagrammed what's under your audio deck, you can see the difference from the production schematic and see what and where the local audio output power is appearing on the rear terminal board. One mod I saw in a Navy receiver was two small jumper wires atop the front panel terminal board right behind the receiver name plate. The meter circuit is by passed and a half watt like local audio is present on the rear apron at the line terminals. AC volt meter and (2 ea 1200 ohm 1/2 watt resistors in parallel) a 600 ohm load on the line output. Do you meter 2.5 milliwatts? or 500 milliwatts.? Line level is 0 VU is equal to +4 dBu, or 1.228 volts RMS, a power of about 2.5 milliwatts when applied across a 600-ohm load. 0 VU is often referred to as "0 dB".Local Audio level is about 1/2 watt. I was looking for a dead meter circuit and had a WTF moment while I digested that modification. With a fair looking insulated wire you had to know what production looked like to see

the modification when installed. (soldered in) Two jumper wires on the front panel terminal board straps the meter bridge and limited line level output components and delivers the full line audio output to the rear terminal board. If the meter moves with the battery poke test, then the loss is in the audio deck, harness, back panel chassis terminal board. A couple pins in the wire harness connector may need some solder work. A cold solder joint now different after 50 years and couple transport vibration shock rides. Field engineer employment opportunities.? It is time to eye-ball the underside of the Audio deck for evidence of some post manufacturing solder flow. And just run the ohm meter through the circuit. Broken wire on the meter range switch behind the front panel. Fuzzy wire short. Broke switch wafer. Mod one use TB 11 - 12 as line out 1/2 watt strap R111 to R112 on the front panel terminal board. Mod two strap R111 to R114 (insulated wire) and R112 to R115 (insulated wire) line out is 1/2 watt and meter circuit just hangs as far more load than the output of 600 ohms. So the meter acts very lame. We would watch line level meters go tick tick tick as we zero beat sub audio. Stay with it Dave as time allows. R390 's are a hands on hobby. Respectfully, Roger

Date: Sat, 6 Apr 2019 23:54:01 +0100
From: jm <josemic@gmail.com>
Subject: Re: [R-390] carrier meter

Hi everybody. This is my first post and it is about the carrier meter. Has somebody made a scale with the equivalent values in terms of S based in the carrier meter 0-100 indications? I am confused. In some threads of the reflector it is mentioned that S9 corresponds to a reading of 34 in the scale. But, is it correct that S9+10 would be 44 and so on? I read every issue and I am very impressed with the technical level.

Date: Sat, 6 Apr 2019 17:47:47 -0700
From: Larry H <larry41gm@gmail.com>
Subject: [R-390] R-390A DB on c/l meter and S signal levels

Hi Jose, Welcome to the R-390x forum. Your English is very good. Hope you are enjoying your R-390A. Yes, the S9 equivalent is 34 db and each additional db on the S scale is an additional db on the R-390x scale, so you have it right (S9+10 would be 44, etc.).

Date: Sat, 6 Apr 2019 20:55:43 -0700
From: Larry H <larry41gm@gmail.com>
Subject: Re: [R-390] R-390A DB on c/l meter and S signal levels

Jose, I found this chart I made up about the relation of S signal levels to db. It's attached. Note the difference between the kwm2 and the R-390A.

Date: Fri, 12 Apr 2019 14:52:19 +0200
From: <fdigiol@gmail.com>

Subject: [R-390] R: Antenna trimmer

Thank you Larry for the kind answer. I'll go and check the messages.

This morning I have made the modification at R523 as described by David Wise. I installed a new Allen Bradley 100 Ohm potentiometer and, at the moment, a 8.2 Ohm resistor for R537. When some resistor I ordered will arrive, I'll change its value to 6.8 Ohm. This upgrade is awesome! No problem to calibrate the Carrier Level Meter. What a smooth adjustment!

I put 100 uV into the antenna input and adjusted R523 for 100dB on the meter, as written on "The Almost Ultimate R390A Upgrade Schematics" of Perry Sandeen (thank you Perry for your invaluable help). I checked the meter with 10, 20, 30, 80, 90 uV and the meter indicates 10, 20, 30 .80, 90 dB!!! Fantastic!!!!

Thank you guys!
