By Jan Skirrow

Adapting Surplus Meters for the R-390A

As most R-390A enthusiasts know, the original R-390A meters contain a small amount of radioactive material. So long as the meter seal is sound, this poses little or no risk. However, radios released to the surplus market recently have had the meters removed for safety reasons. Thus, one of the first tasks confronting a restorer is to locate suitable substitutes.

Used, but often battered, original meters can be found, and new replicas are available at a price. The search for a more economical substitute led me to look at other possibilities. I've been able to locate suitable surplus meters that are cosmetically much like the originals. Unfortunately, they often have different electrical characteristics and sometimes different scale markings.

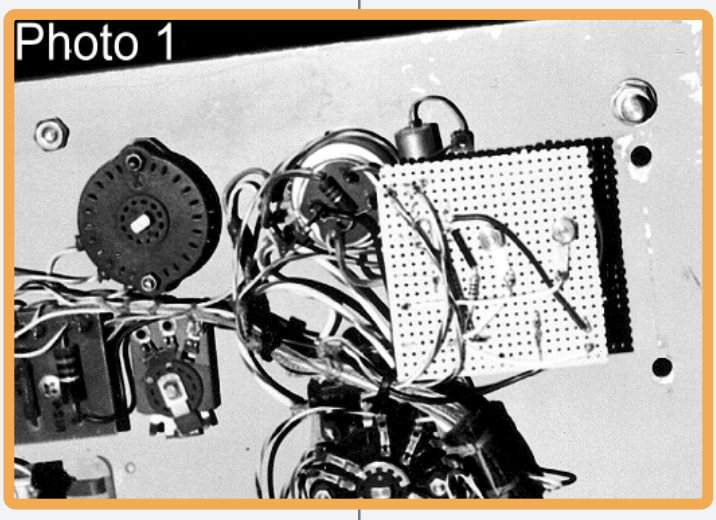
Photo 1

The original line level meter is a Vu meter that I've yet to find an exact substitute for. This meter, with its associated range switch and resistors, is connected across the line audio output. I found meters of the correct size and shape with Vu markings. These particular units have DC movements, and require an external diode to work as a Vu meter, and a shunt resistor to correct the reading.

To calibrate such a meter, connect a modulated signal to the receiver's input and terminate the line audio output with a 600 ohm resistor. Set the audio line level switch to 0. The meters I found all have a marking of some kind that corresponds to 1 mw. Adjust the line level control until the audio line level output (measured using an rms voltmeter) is 1 mw. Then select a shunt resistor for the meter to give the correct reading. For the meters I have, this is usually a few hundred ohms. You might find a substitute meter that is too insensitive to allow this to be done, but so far I haven't.

The carrier level meter is a more difficult issue. The meter is a 1 ma FS movement, and is part of a bridge circuit. The internal resistance of the meter critically affects its operation, and none of the substitutes I've found so far work properly. These meter grudgingly give a modest reading for a very strong signal! I first considered modifying the bridge circuit so that it would work correctly with the different meters I had. But I decided not to do this, as the modifications might have an undesirable effect on the AGC circuit, might not be easily reversed, and likely would be different for every meter I

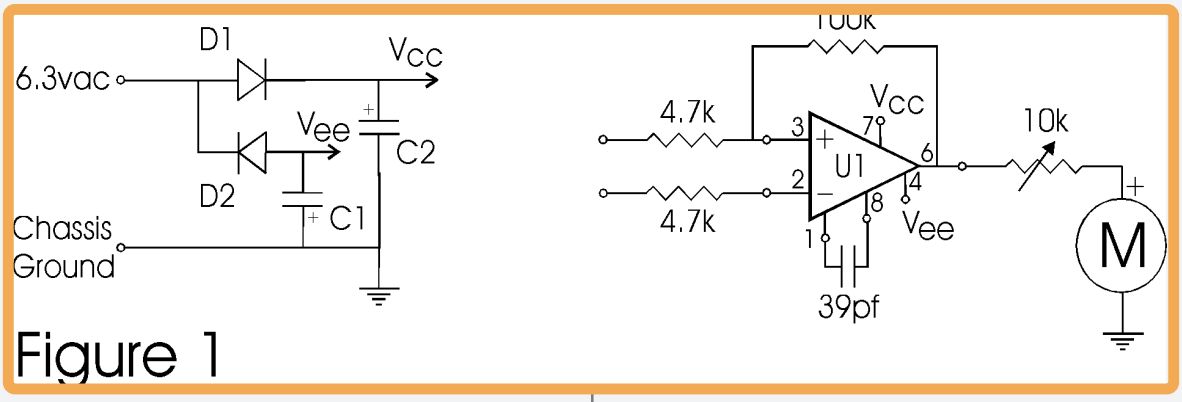

Figure 1

might find.

Instead I decided to use a small amplifier that could be adjusted to match a range of low current DC movements. I wanted it to be easily removable (if I find decent original meters at the right price I'd still rather have them) and not too obtrusive. A simple operational amplifier would do the trick, but the big problem was where to get the power. I decided that I could derive the voltages I needed from the 6.3 vac that supplies the panel lamps.

The op amp, and its associated components, are mounted on a small piece of perforated board fastened to the back of the meter using its terminals. Photo 1 shows the mounted board from the back. The dial lights receive power through R-124, the 1 watt carbon comp resistor at the left end of the front panel circuit board shown in Photo 1. A single wire to the supply side of R-124 provides 6.3 vac. The wires that normally connect to the meter now go to pins on the upper right corner of the perf board. The circuit ground goes to the ground lug that mounts on one of the meter screws.

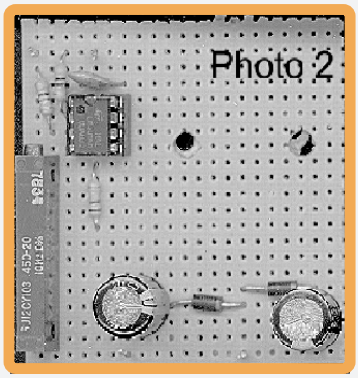
Photo 2

The circuit is very simple. I used junk box parts for my "prototype" and the schematic is shown in Figure 1. The op amp is an LM-301A. The feedback resistor essentially sets the gain. I have used a value that works with the trimmer resistor and meters I happened to have on hand. You may have to play with these values, depending on your meter. The small compensating capacitor is needed by the LM-301A. I breadboarded this circuit with several other op amps, and it should work with almost anything you have. The power supply gives me the voltages the LM301-A needs. The electrolytics I used are 25 vdc, 47mfd, but these values aren't critical. The silicon diodes can be almost anything available.

Photo 2 shows the component side of the board. The layout is anything but critical, and depends mostly on what components you decide to use. The parts are mounted on the side of the board facing the panel, as there is very little clearance between the meter and the RF module. As long as you remember to leave space for the meter body and mount the trimmer where you can get at it, little can go wrong!

Setting it up is simple. Set the trimmer for mid-range, and with the receiver's RF gain control set to minimum and the AGC on, adjust the carrier meter adjust control on the I.F. chassis for a zero meter reading. Tune in a fairly strong broadcast signal, turn the RF gain control to maximum, and adjust the trimmer for a suitable meter reading - say 75% of full scale. You could calibrate the meter properly with a signal generator, but I didn't. Turn the RF control back to minimum and check that the meter is still reading zero. If it isn't, touch up the internal carrier meter adjust, and that should do it. The meter should now be lively and useful for

comparing signal strengths.

Future work will look at using the same approach to drive an external large-face meter. Also, I'd like to mount the components in a small plastic box which could be hidden underneath the meter so that it would be even less obtrusive, and yet still easily reversible.

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