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Tuner Transformation

Make your Heath SA-2500 antenna tuner truly automatic.

While I haven't heard of any fingers getting worn out from adjusting the dials of an antenna tuner, the three-handed balancing act it takes to get on the air is not something I look forward to. The Heath SA-2500 automatic antenna tuner looked like the answer to more than 20 years of trying to use one none-too-optimized antenna for all HF bands. Just put a little power into it and let it find its own match.

Almost!

Probably to limit the already very complex circuitry, the SA-2500, although equipped with a motor to drive the rotary inductor, requires you to set up to 18 different preset points on that coil, nominally two for each band. Unlike some other designs, the tuner does not use these presets as a starting point to find the optimum amount of inductance; the designers have relied on turning only the capacitors to find a match.

Although theoretically capable of matching nearly anything with its high-pass-filter type circuit, the SA-2500 has a tuning range that is quite limited once a preset has been set. And for absolutely no reason I can think of, Heath has chosen to mount the 18 preset-control potentiometers on the main circuit board. You have to remove eight little screws from the top cabinet cover to get to them.

Also, I can't understand why the circuit won't let you set the inductor manually and find the best match from there. If you go into automatic, the roller coil just spins back to the preset point.

In the case of my wire antennas, I found that daily variations (hot and cold, ice on the trees) were affecting the system so that the tuner could not get an adequate match. This was a real disappointment. Running a tuner without its top cover is poor practice, and fiddling with those printed circuit controls makes a mockery of the automation electronics I spent a week assembling.

There are two obvious answers—cutting a trap-door in the top cover or outboarding the potentiometer array. The first is pretty crude. While the second could actually be worked via the 9-pin connection on the back, the thought of a little box with nine pots to turn was a bit much to take. Then, too, there was the problem of how to watch D359, the LED that lights when you've matched the electronics with the roller inductor position.

> ***"Daily variations were affecting the system so that the tuner could not get an adequate match."***

Several hours of staring at the schematic and the manual's none-too-clear explanation of the relevant circuit yielded an answer. By replacing a single fixed resistor with a remote potentiometer, I could vary the range of *all* the pots up or down, quickly and accurately, just like a vernier. This, of course, voids the warranty, but the unit can be restored to its original condition easily.

Say the original setting for doing 40 meters on the rollers was 12. As modified, the remote potentiometer's value would be set to the same value as the original resistor, so the setting remains at 12.

One fine day (probably the next day) you won't be able to get a match at that setting. A small adjustment of the remote pot will vary the setting up or down until things come into resonance. Now the first try will, of course, have to be experimental, but once you've done it a few times, it will be nearly as automatic as the tuner should have been.

Another nice feature is that after you move the range of all the settings, setting things up on one band (at least in my case) brought all the other settings very close. I was using the same antenna (a small vee) on all bands, so you may not notice this with your setup.

I would highly recommend using a 10-turn precision pot in this application for ease of adjustment and reproducible settings. Using the type with a shaft for a knob instead of the screwdriver-adjust type makes things *much* easier—and it's designed for heavier use. The one that I used (Bourns BP3540S-1-1K) costs about $14, but flea markets and junk boxes are good sources since most people have little use for such pots. A 1k pot should be used.

Similarly, the use of a turns-counting dial makes things much more convenient. This device is made to match the pots, and generally can be found at flea markets attached to some incomprehensible piece of junked test equipment.

Remove resistor R452—it's the 220-Ohm resistor on the left edge of the main circuit board of the SA-2500, when looking at the unit from the front. Now set your 10-turn pot to 220 Ohms, using an ohmmeter. Attach a pair of shielded wires to the points where R452 used to be and run the wires out of the cabinet to your 10-turn pot—one wire to the wiper connection, the other to the pin 1 end. This would be pins 1 and 2 of the Bourns control mentioned before.

Of course, you should ground the braid of the shielded wire near its end. If you don't have two-conductor shielded wire, use two pieces of RG-174/U and ground both shields. The length doesn't seem especially critical, but since you're apt to have a lot of rf floating around, try to keep it short. You might be able to figure out how to mount the pot on the front panel, but I couldn't—unless you want to sacrifice use of the antenna switch.

I found there is plenty of room between the

multiple-pin connectors and the chassis for slipping wires. You may have to use normal RFI measures on the wire (ferrite beads and capacitors), but I noticed no changes running the full legal limit. You also might want to put the potentiometer in some kind of box to make it look nice.

Setting the dial to something appropriate, such as 5 if it's a 1-to-10 scale, will give you a reasonable frame of reference. To match the resistance value, 2.2 also would be a good choice.

And that's it. If you don't change anything, your settings will stay the same. You can override the preset when you need to and still preserve the automatic feature. When you do, remember to turn the dial slowly and keep an eye on the readout, since you don't—under any circumstances—want to let the inductor run against the stops.

A Few Notes

While the manual doesn't specify it, communication with Heath indicates that the gray multi-conductor cable coming from the sensor assembly should be dressed away from the variable capacitors and placed flat against the rear panel. Otherwise, due to the very high voltages encountered, an arc can develop from the capacitor to the cable, with disastrous results.

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Heath also suggests that turning the antenna-selector switch be done with a sharp, snapping motion, due to the flexing in the 16″ shaft. Using a gradual motion may leave the selector switch set in some in-between position.

Finally, high-power rf and solid-state electronics don't always mix too well. In my case, I noticed that the tuner easily found a match at low power, but as soon as I switched to high power, the motors ran continuously. The Heath service consultant said he had heard about this before but could offer no solution. "Use a coaxially fed antenna" is not what I call a solution!

The easiest answer is to let the tuner find the match at low power and then switch into manual mode. I was able to improve the grounding (by using a resonant ground), so the problem went away. I also improved the shielding by scraping away the paint around the cabinet screws wherever the two halves of the cabinet came into contact with the chassis.

With these provisos in mind, if you're going to be chasing DX up and down the frequencies, or even if you prefer just getting on the air to fiddling with knobs, the SA-2500 is a useful accessory at a price not much higher than a manual tuner. ■