CASCADES AMATEUR RADIO SOCIETY ATTENTUATOR

The following is a homebrew project that will go with the DF Antenna built back in 2010. This manual is broke up into four parts. The Inventory portion should be done first no matter what! The Switches and Box sections can be done in any order that you want...that is to say do the Box then Switch section or do it as listed in the manual.

The last section tells you of only one part that we will do as a group. The final section is about how you will mount to, to any, antenna or just leave as is. The attenuator must be close up to provide RF security from outside interference...but a minimum of four sides and two ends are about all is needed. This is not a bench instrument, so don't overkill the RF shielding as it is not needed as long as the box is closed.

This attenuator will provide up to 120 dB attenuation in 30 dB steps. The ideal use would be with the DF antenna we built last fall at a group build club evening.

OK, enough of the BS'ing, let's get started and hope you like the Christmas 2010 gift from the club.

Inventory

The “Switches” or “Making the Box” sections can be done in any order, but you should always inventory your parts for any project just to make sure you have anything.

Above are the parts required for make the box for the attenuator. The names of each piece will be explained in the “Box” section.

Below is the remaining parts: four switches, interconnection and jumper wire, one-watt combo of two 107 Ohm resistors in parallel, braid to fashion a hinge sort of device I will explain at the meeting, seven each of 53.6 Ohm resistors, and four each of 787 Ohm resistors. All resistors are quarter watt, 1% metal film resistors.

Switches

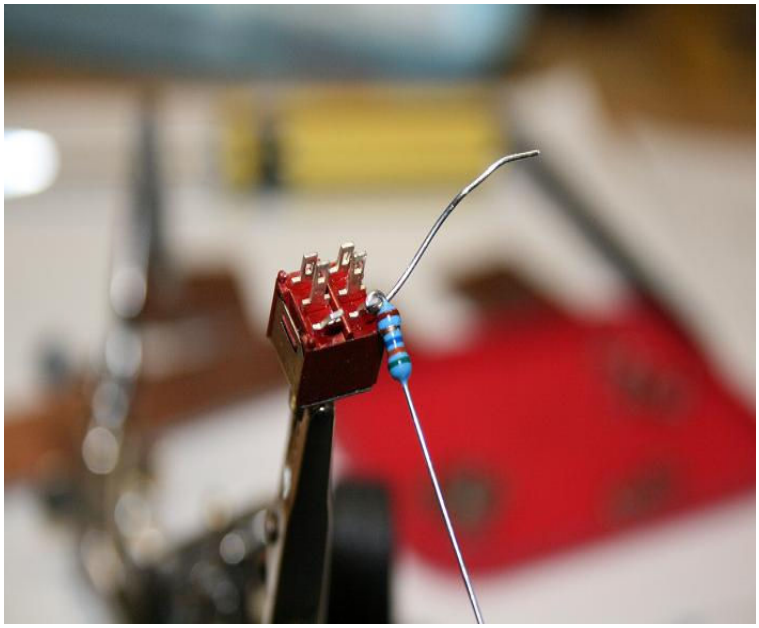
There are four switches in the attenuator. Each switch provides for about 30dB of attenuation, thus the entire attenuator provides 0 to 120 dB of attenuation in 30 dB steps. Each switch uses a pi-type network of resistors consisting of one series resistor of 787 Ohms and two parallel paths of resistance, each containing a value of 53.6 Ohm.

The first half of the first switch, at the input of the attenuator (transmitter side), has two 107 Ohm resistors paralleled to give one watt protection in the event that the attenuator is overloaded. The second half of this first switch is wired with a single 53.6 Ohm resistor. The remaining three switches are all wired identical.

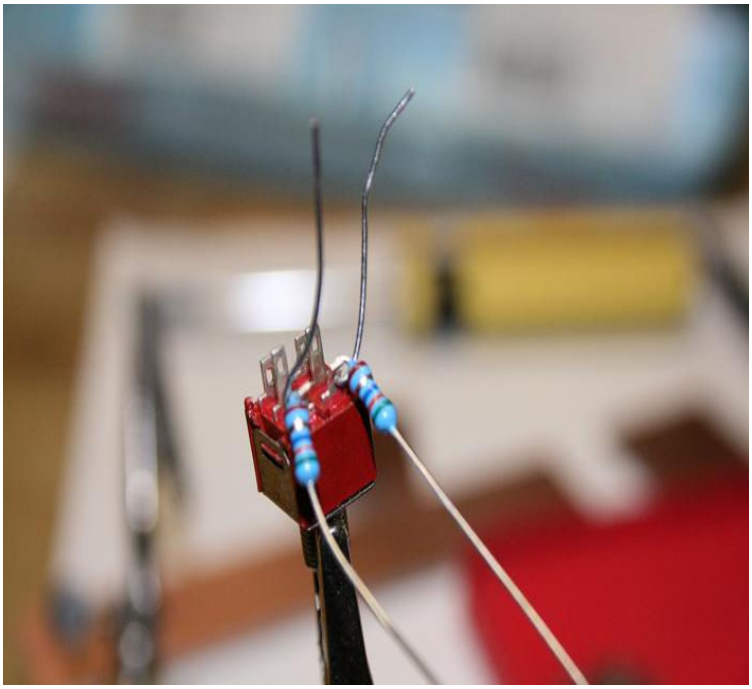
The switches are three position switches. First position is 0dB, second is OFF, and the third position is 30 dB. In hindsight, I wish I had ordered just two position DPDT switches and that would have eliminated the center OFF position. On one side of each switch is a jumper to provide a route around the attenuation resistors (0 dB attenuation). The other side of the switch is the attenuation resistor network (30 dB attenuation). The middle position (OFF position) serves no purpose.

For the three identical switches (switch 2, 3, and 4), wire up in the following manner:

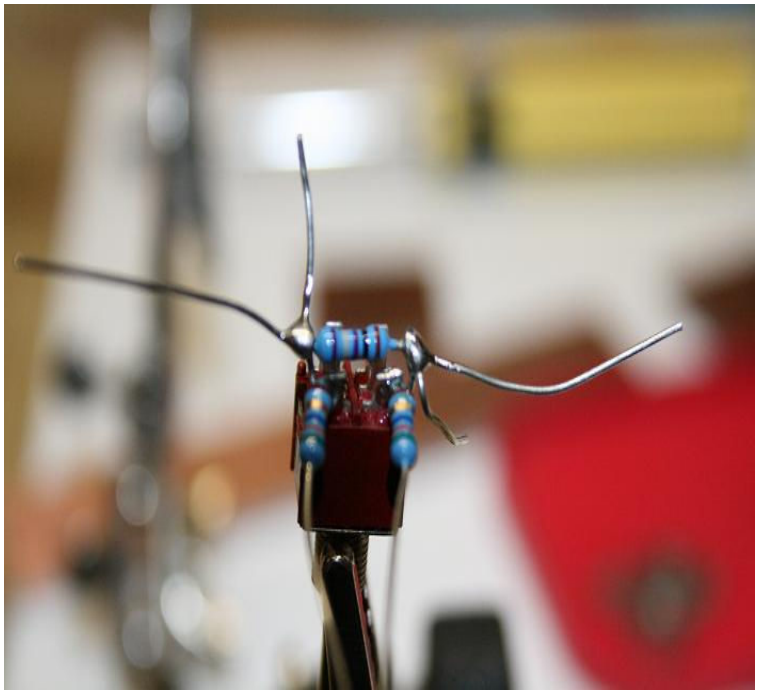
a. Install a 53.6 Ohm resistor on one of the switch tabs.



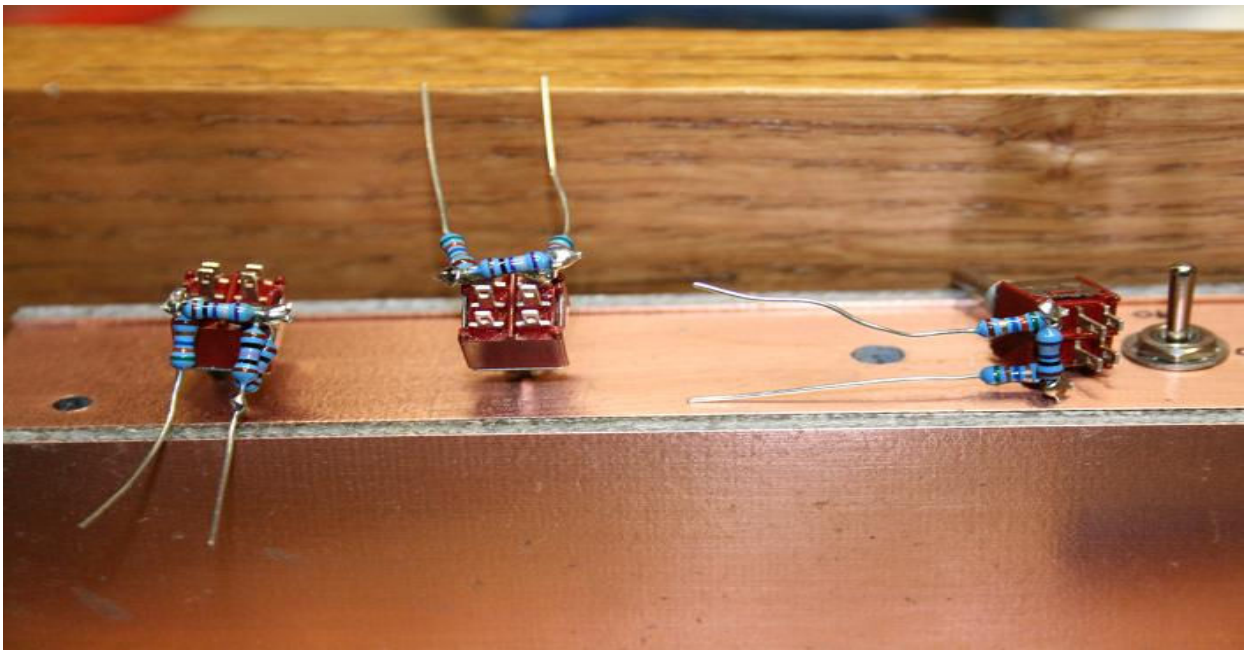
b. Install another 53.6 Ohm resistor on the other tab.



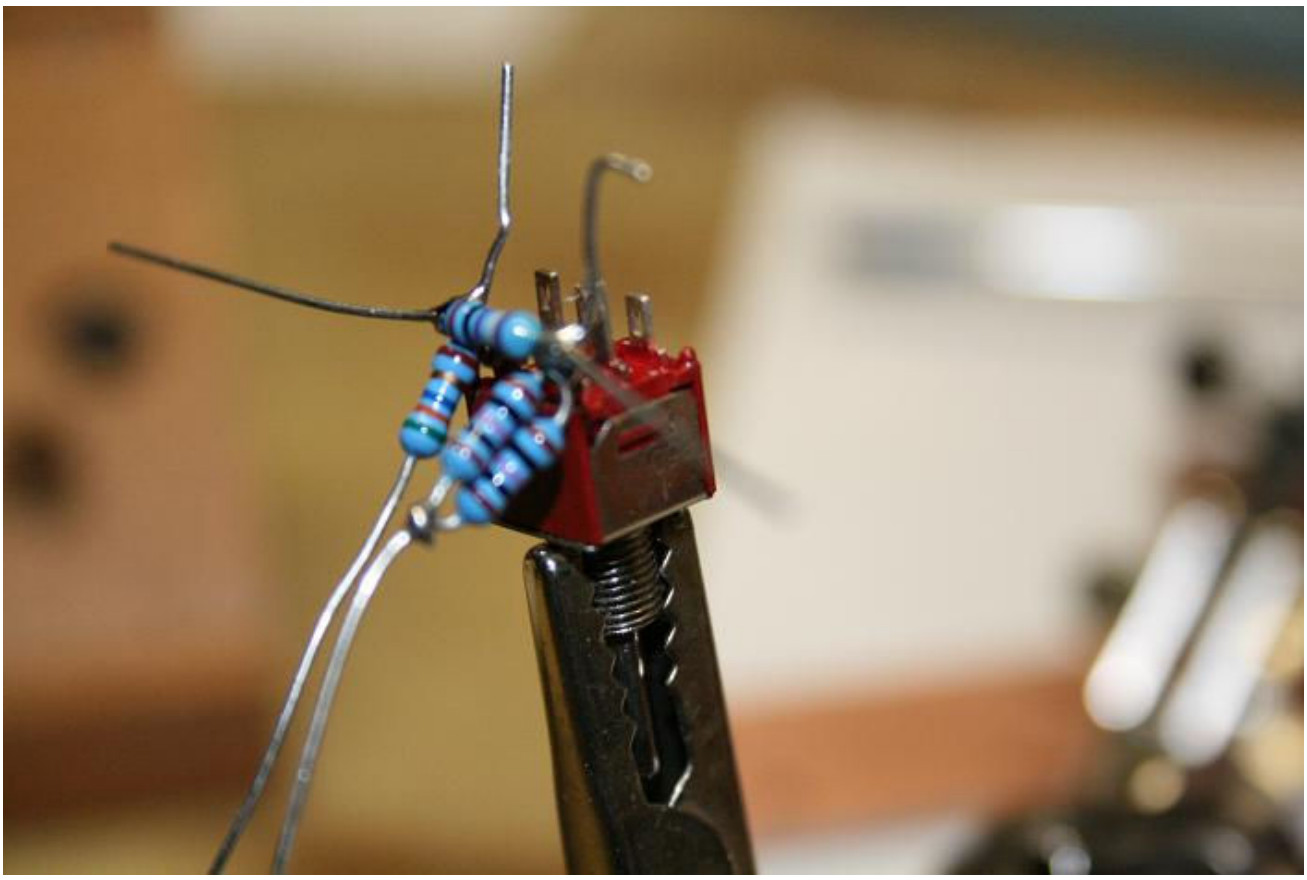
c. Install one 787 Ohm resistor across the two tabs.



Here is another view showing those three switches:

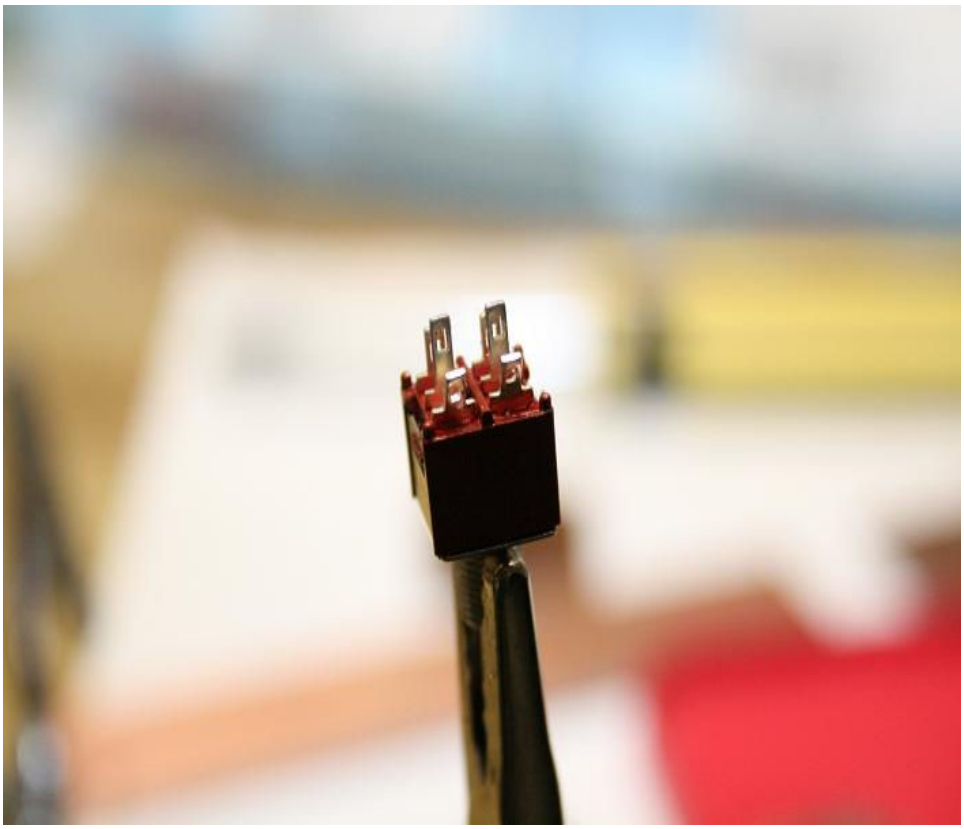


The first switch is identical except the input side of the switch (this is the side that gets the signal from the antenna), two 107 Ohm resistors are paralleled to provide the 53.6 Ohm's, but more importantly this gives one watt of overload protection to your attenuator. See below for a picture of that first switch.



The threaded shaft used to screw down the switch has a beveled grove in it. I used this an orientation

for all four switches.

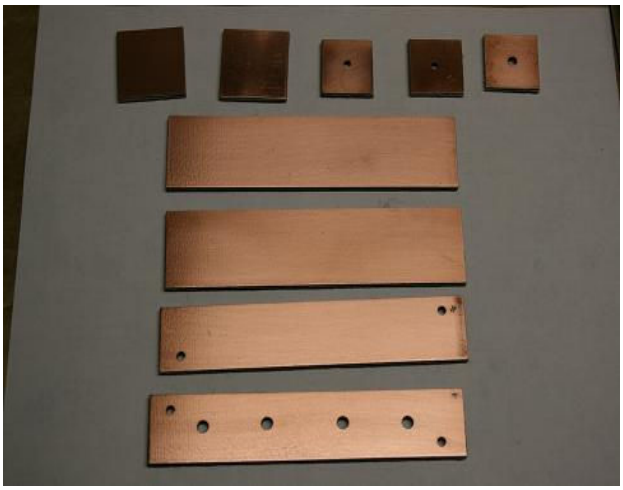


The above photo shows two tabs bent slightly forward allowing easier access for the wires on the paralleled resistors. Note – the beveled grove is on the other side of the bent tabs.

The Chassis or Box

I found after three attempts, that a large flat soldering iron in the 100 plus watt range to the best for making the chassis (box). This is especially true is you plan to solder (weld) shut the box to ensure a complete RF tight enclosure. For our purpose of a attenuator for two meter fox hunts, this complete RF tight enclosure is overkill and not needed.

The first step is to identify your parts for the box.



The left and right photo shows the nine parts to make box. The three smallest squares with a hole through them are the **spacers**. The two large squares are the end caps. The fours remaining parts are the four pieces to make the box of the box. The two with no holes are the two **sides**. The part with only two holes is the **bottom** and the one with six holes is the **top**. All four are 6.25 inches long. However, the two **sides** are 1.25 inches in width, while the **top** and **bottom** are only 1.00 inches in width. This is to ensure we end up with a somewhat square box. I use the word somewhat, depending on your ability to heat a massive amount of surface area made of copper. This is the hardest part of the whole project in my opinion.

I would suggest you **tap solder** pieces together and then verify square corners before permanently solder the two pieces together.

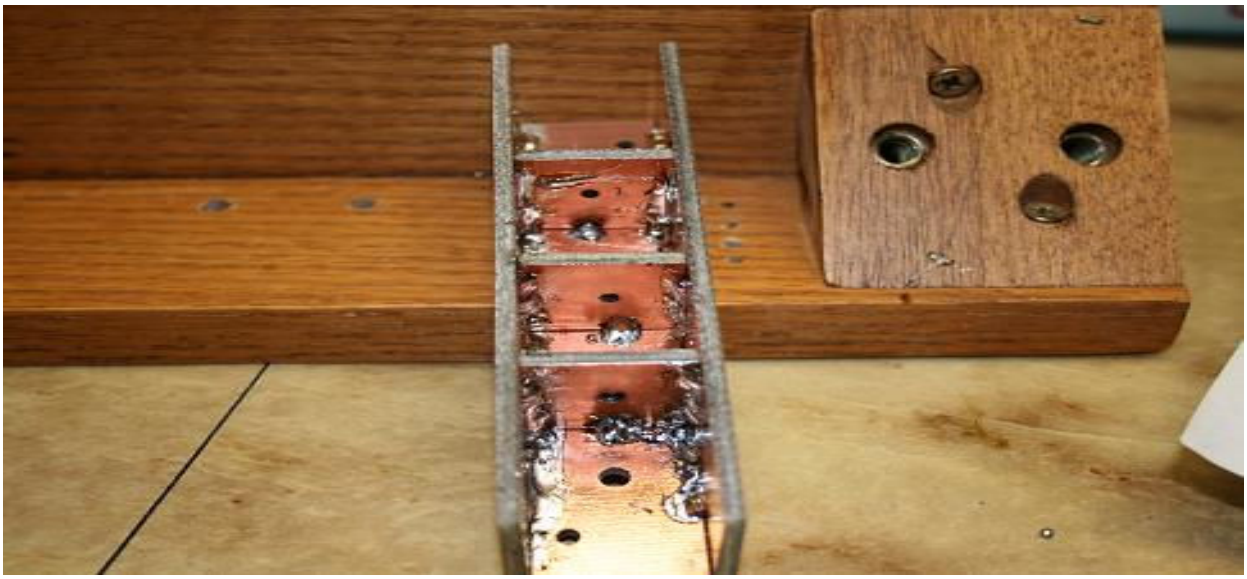
Solder the **top** piece to one of the **side** pieces. Remember to solder both the **top and bottom** to the inside edge of the **side** pieces. This will use up the extra width of 0.25 inches to make a 1 inch square box.

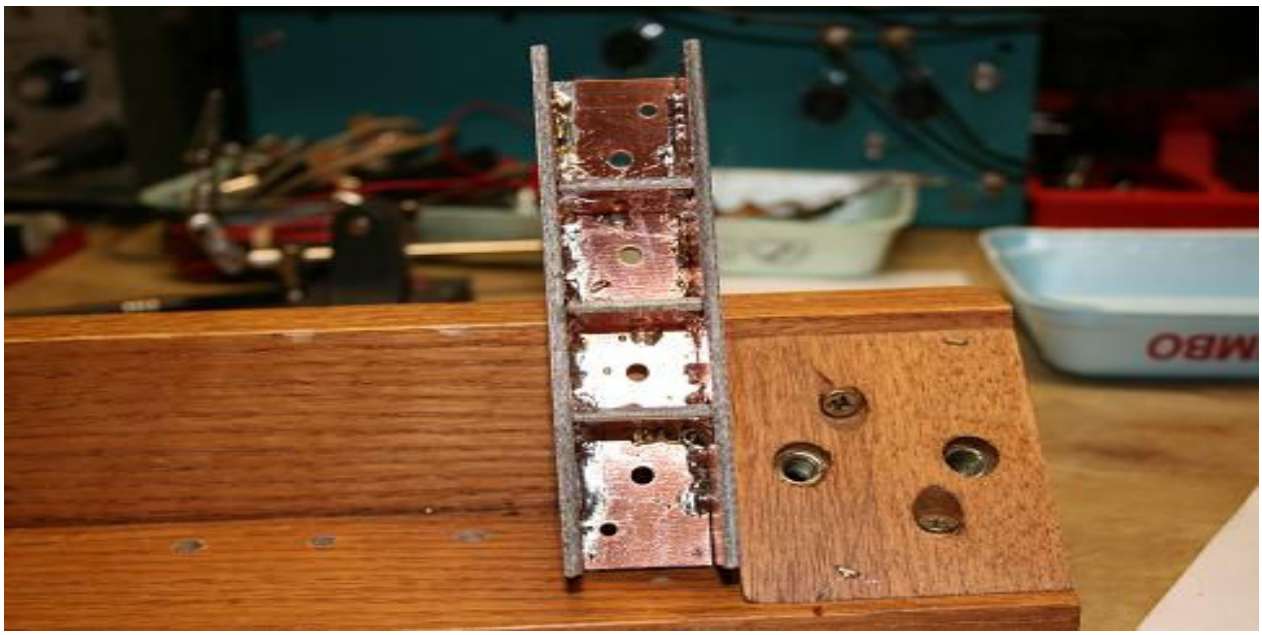
To make sure you have square corners (90 degrees), I would use one of the provided jigs, these are the legs off my wife's coffee table [don't tell her though...she thinks I am refinishing the table]. After you have made the two pieces square to each other, tap solder the two pieces together, re-verify the 90 degree angle and solder it to a permanent state of existence. Then, I would solder in the **spacers**. This is done my eye to your best judgment.

I show two **spacers** installed above. You will install a total of three **spacers** so each switch hole is isolated from each other switch hole.

After that, you install the other **side** piece. Again, tap solder until your sure that you have attached the side at a 90 degree angle of the **top** pieces...this is to ensure a square fit and a nice looking box!

Here are two more pictures to show what you should have up to this point.



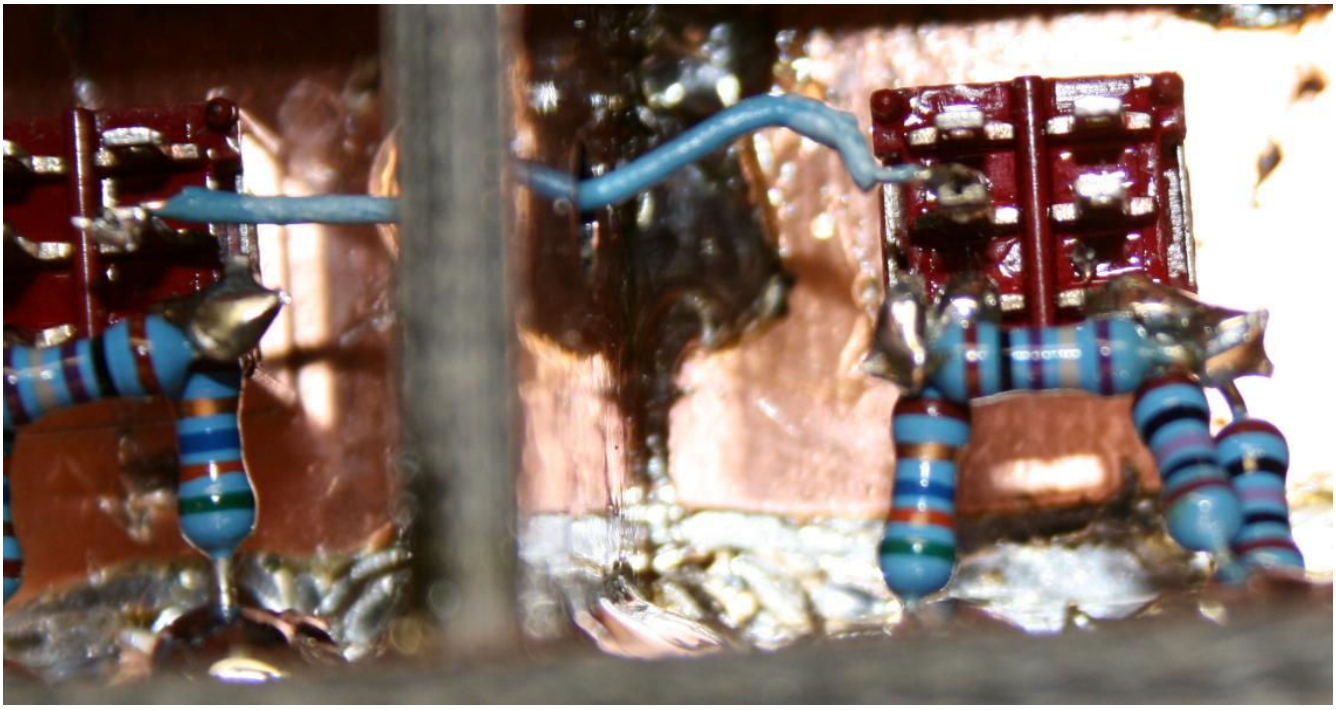


The Final Two Steps

I will detail only the first of the last two steps. The last step is attaching input and output cables from the antenna and to the radio, and mounting the Attenuator to the DF antenna. Since I don't know what type of connectors you will use, the type of coax or how you might want your attenuator mounted, I will leave those details to you.

The remaining step you will do as a group, is to install a jumper on each switch, install the switches in the box, and inter-connect them.

You can either install the jumper wire on the two top connections on each switch before or after you install the switches. It is easier to do this step prior to the switch installation.



This photo actually doesn't show this jumper, but you see the two blank terminals at the top of the switches...this is where the jumper goes.

Now for the interconnection of the four switches...one must use the center terminals of each switch to attach each jumper.

The above two photos show how this interconnection looks when done. Also note, that the jumpers that are attached to each switch are shown in the photos.

With the four switches attached and all orientated properly, the outside looks like this:

Remember how the switch works...the top of the switch that has the little switch lever is thrown toward the one direction with the attenuation resistors attached the terminals underneath in the opposite direction.

When mounting the attenuator to the antenna, you can use two long bolts I have provided. Notice the **top** and **bottom** pieces have two small holes, one on opposite ends of the two pieces. Also note the little “x” mark on each piece, these marks are to show the correct orientation of the **top** and **bottom** pieces. The marks will be facing each other when correctly installed.