Remote Switching for 80-, 75- and 60-Meters for your Butternut Vertical
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Introduction

The Butternut HF2/HF6/HF9 series of vertical antennas are extremely flexible in that they provide ***almost*** all-band HF coverage when fully loaded with all optional coils (160, 80, 40 and 30 meters for the HF2) – the exception being 60 meters. In my case, I've been using an HF-6 vertical with the 160-, 17-, and 12-meter optional coils for almost 20 years! So I've been happy operating all HF bands with this single antenna. However, I wanted to fix the 60-meter "hole" in my HF coverage. Also, the bandwidth of the Butternut vertical is very narrow on 160- and 80-meters due to its short length (26-feet). This really hasn't been a problem since I operate CW almost exclusively on the HF bands. However, I have wanted the ability to occasionally transmit on 75 meters primarily because of the trader nets located on this band.

Adding the Coverage

As Butternut owners know, it is easy to move the resonance of the antenna on any band by compressing or stretching the large coils associated with those bands. So the first thing I tried was to short a number of turns on the 80 meter coil with a clip-lead to see how the antenna would work across 80 meters, and even up to 60 meters. This worked great! However, I wanted a way to remotely short these turns so I wouldn't have to run outside to manually make the changes.

As it turns out, it is not difficult to remotely short out turns on the Butternut 80 meter coil to switch between 80-, 75-, and 60-meters. All it takes is two inexpensive power relays, two diodes, a center-off DPDT switch, and some way of housing everything – only about $10 worth of parts! The schematic of my solution is shown in Figure 1. The circuit is designed so that when no voltage is applied, the Butternut stays on the normal 80-meter frequency you've chosen. However when voltage is applied, one relay or the other will be energized depending on the polarity of the applied voltage. I.e., when a positive voltage is applied (top-to-bottom on the schematic), diode D2 conducts. This bypasses current around relay RLY2 so this relay remains non-energized. However, since diode D1 is back-biased in this condition, relay RLY1 energizes and shorts the 12-turns necessary to move the resonant frequency of the antenna to 60-meters. Conversely, when a negative voltage is applied, diode D1 conducts and diode D2 is reverse-biased. So RLY1 remains de-energized, but RLY2 is actuated. This shorts the 4-turns necessary to move the antenna from 80 meters to 75 meters.

Table 1 lists all the parts necessary, which were purchased from All Electronics and Mouser Electronics. I used hot glue to mount the relays upside down in the plastic box as can be seen in Photo 1. You will need some sort of box inside your shack to house the DPDT center-off switch and fuse/fuseholder. In my case, I incorporated this switch/DC power assembly into an existing box (Photo 2) that I use to provide a memory keyer interface to my FT-1000MP MKV (I homebrewed many of the capabilities of the Yaesu FH-1 Remote control Keypad into that control box to give me memory keyer and low-power tune capability for my FT-1000MP MKV). Of course, you do need to run a 2-

conductor wire from your shack to the antenna. In my case, I'd buried an 8-conductor rotator cable along with my RG-213 when I installed the antenna years ago (I normally don't plan ahead!). The cables are inside a 1-inch diameter pvc pipe for protection, which has worked very well for almost 20-years. Since my Butternut is mounted about six inches from a cedar fence, I mounted the relay box on the fence near the 80-meter coil. An insulated mounting assembly for the relay box could be built from PVC pipe pieces if your Butternut vertical is standing in the clear.

Wiring up the relay assembly is fairly simple. The common wire attaches to the screw at the bottom of the 80-meter coil. The other two wires connect to the 4^{th} and 12^{th} turns of the 80 meter coil as shown. You will need to experimentally determine the exact positions for these two wires based on your desired operating frequencies (I chose 3.6-, 3.9-, and 5.356-mHz). Photo 3 shows the final assembly mounted in place.

I initially used large alligator clips on the 75- and 60-meter wires and my MFJ-259B Antenna Analyzer to find the correct 75- and 60-meter wire positions. While you can leave the alligator clips in place, I decided to solder the wires to the coil for a more robust assembly. Once I identified the correct coil wire-connect points, I marked the 75- and 60-meter locations on the coil with a permanent marking pen. Then I soldered the wires directly to the coil using a Solder-It PRO120 butane torch and Solder-It aluminum solder (www.solder-it.com). To do this, lightly file the coil at the appropriate points to clean the aluminum, apply the aluminum solder paste, and then apply heat from the butane torch to the coil wire below the aluminum solder paste. When you see beads of solder stating to form, apply the torch flame directly to the paste and the solder should flow and "wet" the aluminum wire at that point. Once you have tinned the coil, you can then easily solder the wires to these points with either a heavy soldering iron, or with the butane torch. Photo 4 is a close-up of the 60-meter wire soldered to the aluminum coil.

Operation

Operation is simple. With the switch in the center-off position, you have normal 80-meter operation. Then flip the switch to either apply +12 volts or -12 volts to the relay assembly to select either 60 meters or 75 meters. My SWR 2:1 bandwidth is $\pm$ 50 KHz at 3.6 MHz, $\pm$ 60 KHz at 3.9 MHz, and full band on 60 Meters (5.330-5.403 MHz). As a small bonus, flipping in 60-meters also moves the 160 meter resonance point about 10 KHz higher in frequency if you have the TBR-160. My 160 meter 2:1 bandwidth is 1.808-1.837 MHz when enabling the 60-meter relay.

Conclusion

I've described an inexpensive, simple, and effective means of both extending 80-meter coverage of the Butternut vertical, and adding the new 60-meter band. This solution works very well and makes a flexible antenna even more versatile. Give it a try!

Table 1 – Parts Listing (www.mouser.com & www.allelectronics.com)

QTY	Description	Source/Part Number	Price Each
2	12V 10-amp relay	Mouser 817-FTR-H1AA012V	$1.73
2	Alligator Clips	Mouser 548-70	$0.42
2	1N4001 diode	All Electronics 1N4001	15/$1.00
1	DPDT center-off switch	All Electronics MTS-12	$1.60
1	GMA Fuse-holder	All Electronics FHPM-45	2/$1.00
1	1-amp fuse	All Electronics GMA-1	5/$0.75
1	Project Box	All Electronics MB-97	$1.95

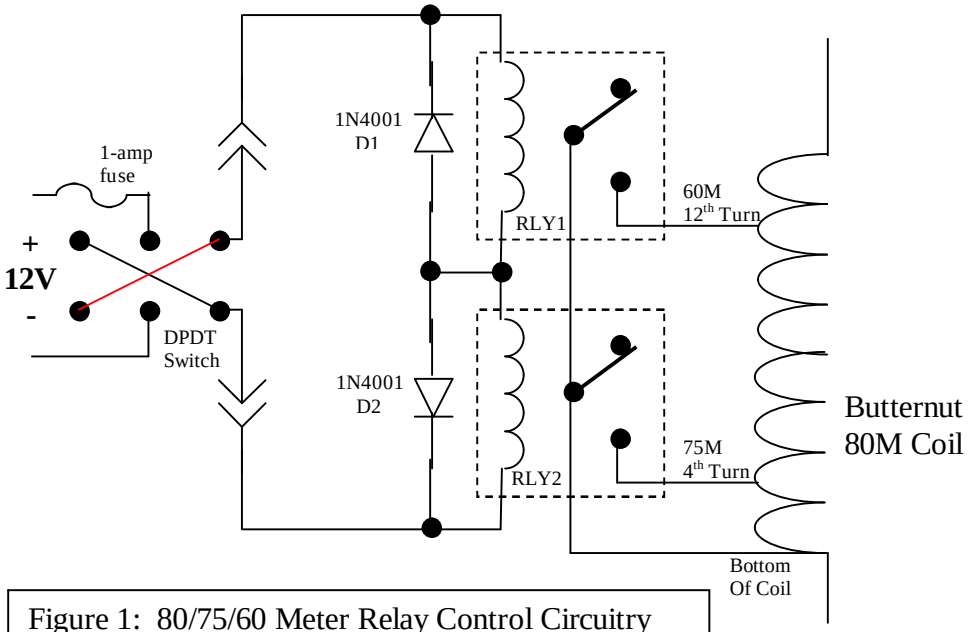

Figure 1: 80/75/60 Meter Relay Control Circuitry

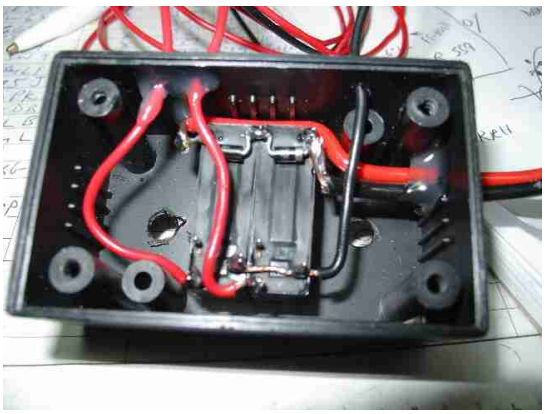

Photo 1: Inside relay-box wiring

Photo 2: 80/75/60-meter switch in shack

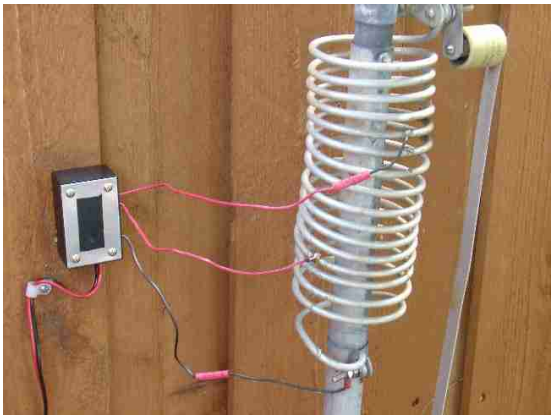

Photo 3: Final outdoor assembly

Photo 4: 60 meter soldered connection