The Nerd Box
By
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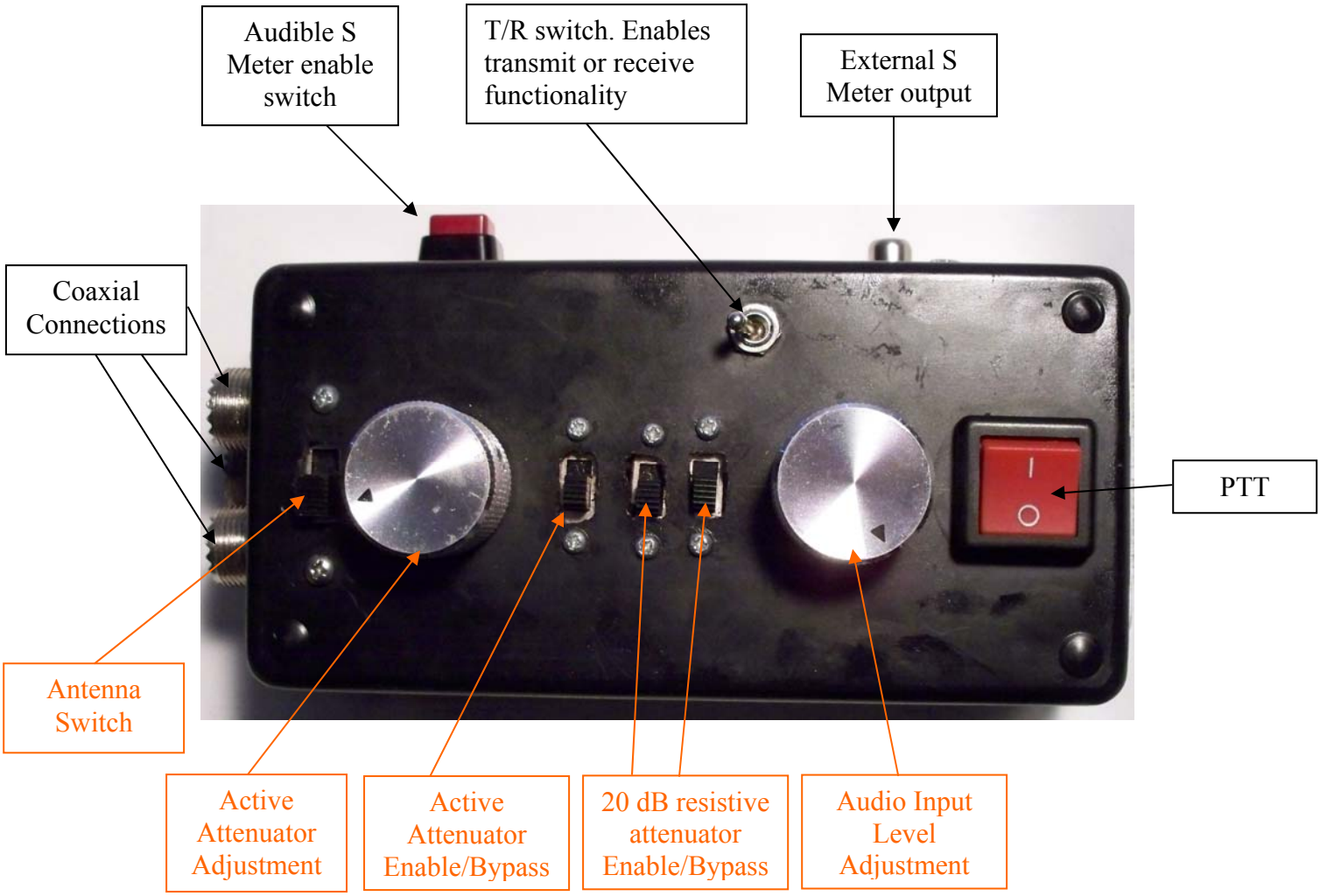
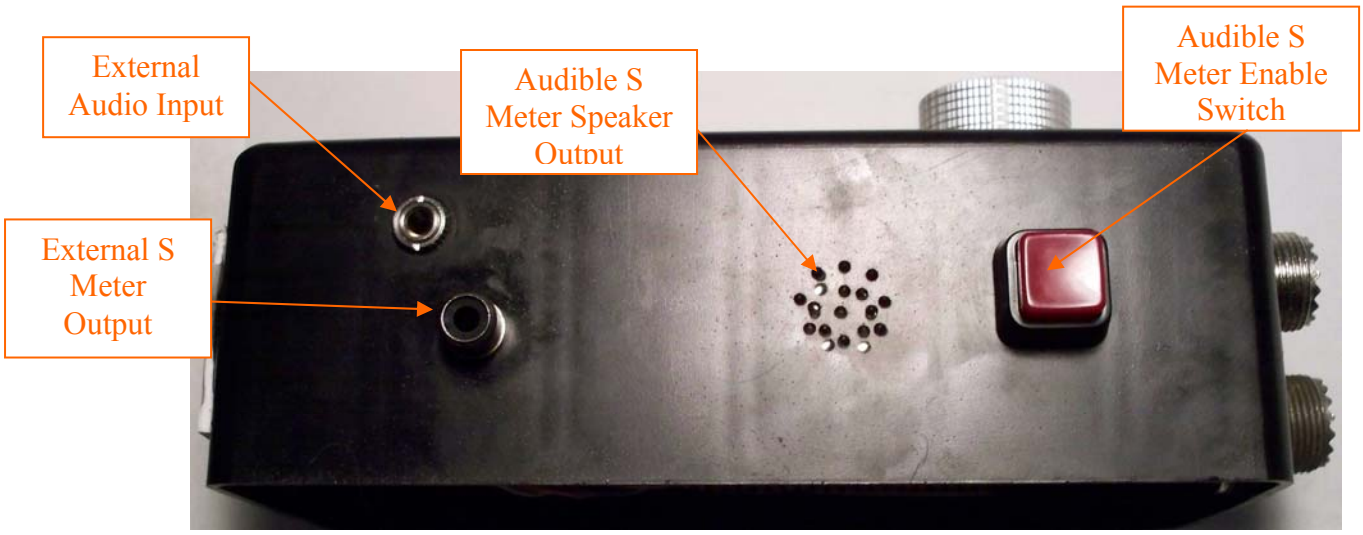
This gadget is a multi function transmitter hunting accessory. There is no real name for it that has jumped out at me, so in the absence of a good name, it has been called the "Nerd Box". This came about because early on in its' development, my competitors erroneously believed it to be overkill. That misperception has been corrected. In one box, it contains a passive and active attenuator, protection against transmitting into the attenuators, an antenna switch, a PTT switch for long transmissions while hiding, an input for external audio material while hiding and a pot to control the level, an audible S meter, and an output to drive an large external S meter. All of the connections to the radio are made thru the slightly modified 8 pin modular microphone jack.

Perhaps a quick chronologically explanation is in order. Originally, this was meant to provide a way to avoid blowing up the attenuators accidentally by transmitting into them. The small quarter watt resistors in the 20 dB step attenuator and the electronics in the offset attenuator would surely be destroyed with the application of 50 watts. By using a switch to select between transmit mode and receive mode, destruction of attenuators is avoided. The PTT from the mic is interrupted when the attenuators are in line. Since I was interrupting the PTT from the Mic Jack, I decided I may as well use the 8V available from the mic jack to power the offset attenuator. Also, since I was routing the coax cable thru this box to insert the attenuation, I decided I may as well include an antenna switch in the box as well. I like using the antenna switch to switch between the directional antenna and the omni antenna. Relative signal strength readings from the omni are very helpful.

Once I realized I was going to have the audio input available, it occurred to me I could use this for the transmit side. I could have a PTT switch for long transmissions, and a place to inject audio from external sources like MP3 players for audio. A pot is available to adjust the audio level.

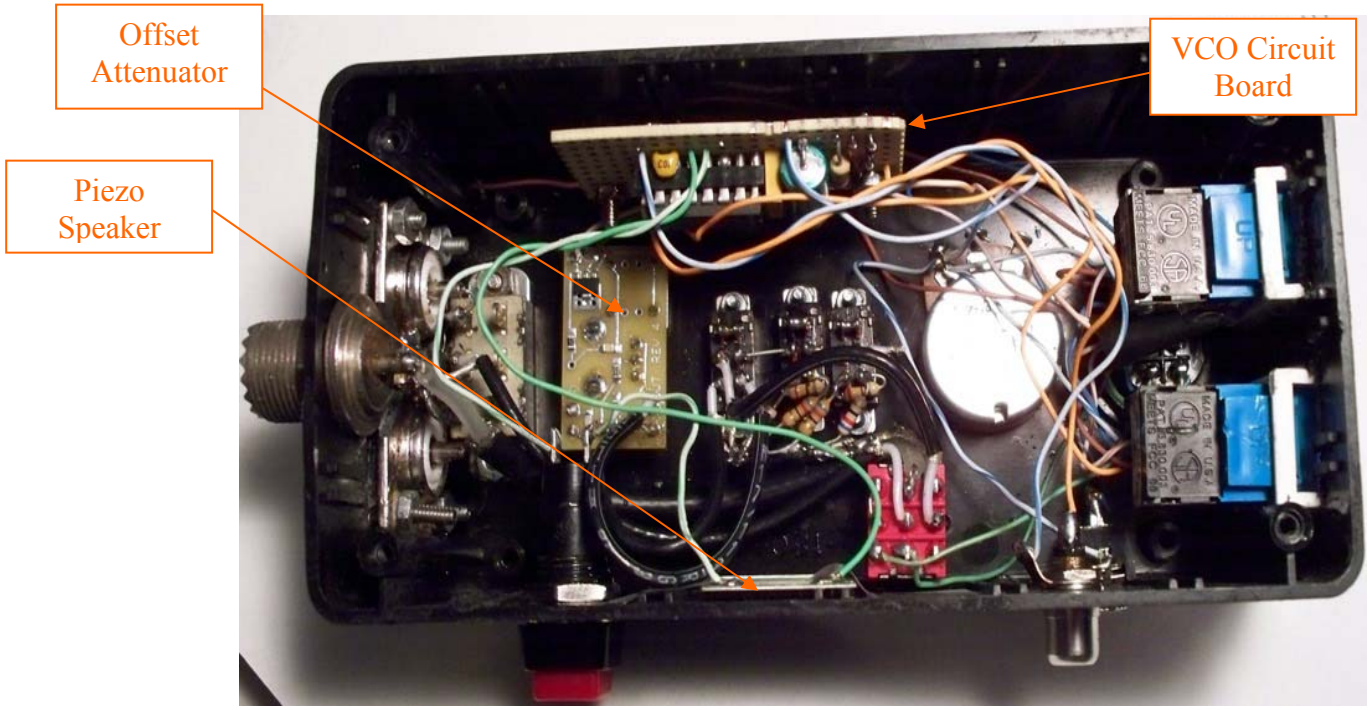
After using this for a few transmitter hunts, I added some other functionality that was in separate units. I had designed an audible S meter for the Puxing hand held which I used while on foot. This design is available as another project on this website. This was so powerful that I decided to implement one in my Icom 706 mobile. The analog signal on the 706 is problematic, however, because it decreases as the signal gets stronger and neither extreme is at 0 volts. I built a circuit I call the "Zeroizer" that is available as another project on this site that converted the 706 S meter output to 0 to 3.5 V. This signal is fed thru the 8 pin mic jack to the Nerd Box, replacing the up/down signal on the hand mic that I never use. The S meter voltage is fed thru to an RCA jack for an external meter, as well as a VCO that drives a piezo speaker for an audible S meter.


Audible S Meter enable switch
T/R switch. Enables transmit or receive functionality
External S Meter output
Coaxial Connections
PTT
Antenna Switch
Active Attenuator Adjustment
Active Attenuator Enable/Bypass
20 dB resistive attenuator Enable/Bypass
Audio Input Level Adjustment


External Audio Input
Audible S Meter Speaker Output
Audible S Meter Enable Switch
External S Meter Output

8 Pin modular connector to radio and Mic

Antenna Connectors



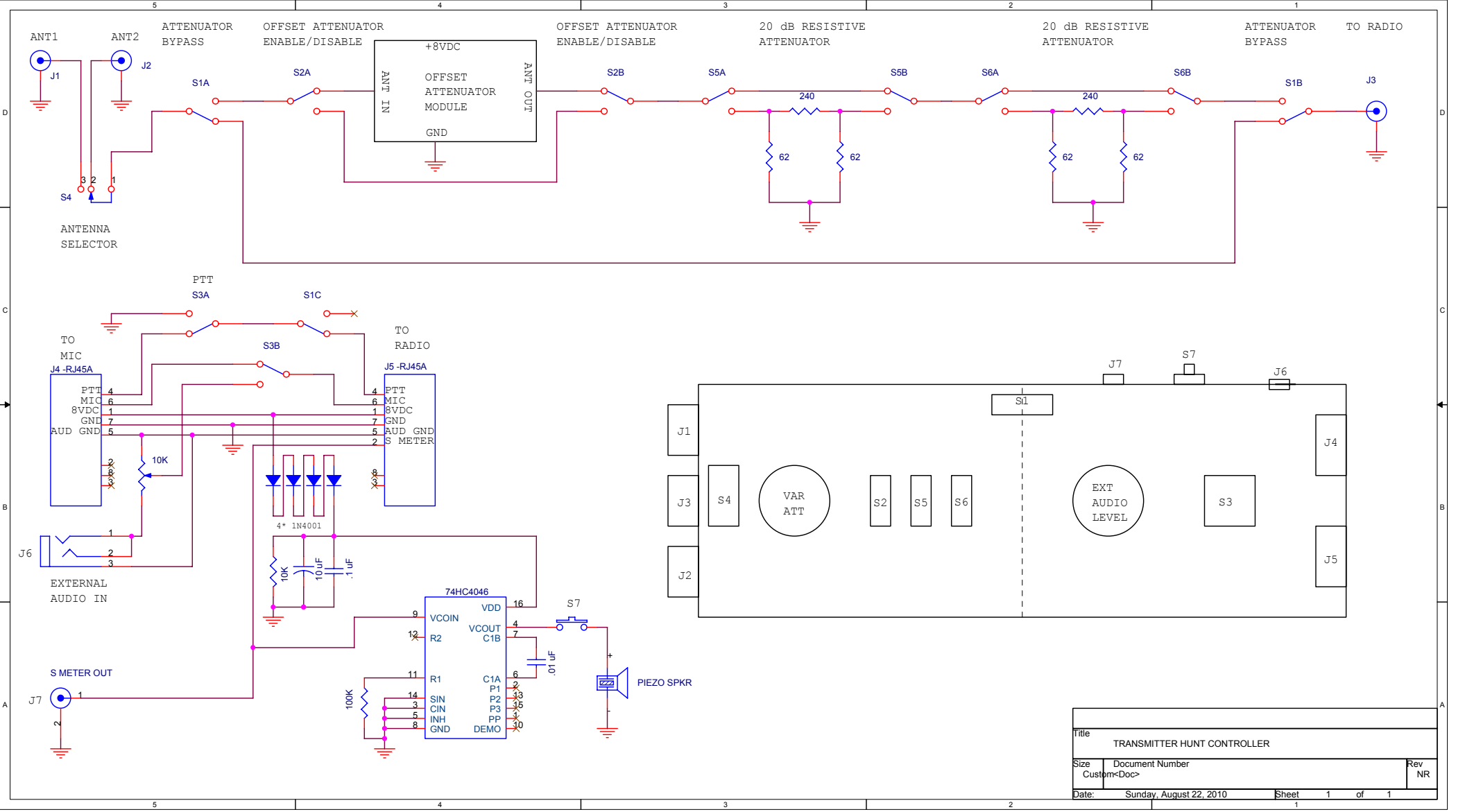
The schematic for this unit is included at the end of this document. The active attenuator is an “offset attenuator” PCB kit from Marvin Johnson, KE6HTS. The 74HC4046 VCO is powered by the 8V from the mic jack as well, with 4 series diodes providing a voltage drop to operate the VCO in a safe voltage region. The S meter voltage drives the VCO, and the output of the VCO drives the Piezo speaker.

A final word on use of the attenuators is in order. I used to use resistive attenuators exclusively. This had the downside that when the signal became very strong when you were close, the attenuators would lose their effectiveness because the signal would “go around” the attenuator either thru lossy coax or power connections in the vehicle. This would mean your attenuator would be useless near the very end of the hunt unless you shielded everything, put RF chokes in the power line, and used good quality double shielded coax.

The offset attenuator removes the issue of the signal getting around the attenuator because the offset attenuator creates a signal on a different frequency that only exists in the attenuator. The radio is tuned to this frequency and the overloading issues discussed before cannot occur. The offset attenuator was originally designed to be used in situations where you are close to the hidden transmitter because of the problem noted above. The offset attenuator presents some conversion loss during the mixing process, but that is not usually an issue because it is usually used when you have an abundance of signal.

I have found the offset attenuator with its pot adjustment so convenient that I like to use it for almost everything. Since it has loss, I use the radio on the fundamental frequency when I start for maximum sensitivity. I then use the one or two of the resistive attenuators before I switch over to the offset attenuator. This gives me a wide range of attenuation without any of the overload effects mentioned before. I can even use the resistive attenuator if required while using the offset attenuator for more attenuation.

Nerd Box driving external S meter


ANT1
ANT2
J1
J2
ATTENUATOR
BYPASS
OFFSET ATTENUATOR
ENABLE/DISABLE
+8VDC
ANT IN
OFFSET
ATTENUATOR
MODULE
ANT OUT
GND
OFFSET ATTENUATOR
ENABLE/DISABLE
20 dB RESISTIVE
ATTENUATOR
20 dB RESISTIVE
ATTENUATOR
ATTENUATOR
BYPASS
TO RADIO
S1A
S2A
S2B
S5A
S5B
S6A
S6B
S1B
J3
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240
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62
62
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3 2 1
S4
ANTENNA
SELECTOR
PTT
S3A
S1C
TO
MIC
S3B
TO
RADIO
J4 -RJ45A
J5 -RJ45A
PTT 4
MIC 6
8VDC 1
GND 7
AUD GND 5
PTT 4
MIC 6
8VDC 1
GND 7
AUD GND 5
S METER 2
10K
4* 1N4001
J6
1
2
3
EXTERNAL
AUDIO IN
10K
10 uF
.1 uF
74HC4046
VCOIN 9
R2 12
R1 11
SIN 14
CIN 3
INH 5
GND 8
VDD 16
VCOUT 4
C1B 7
C1A 6
P1 2
P2 13
P3 15
PP 1
DEMO 10
.01 uF
100K
S7
PIEZO SPKR
S METER OUT
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