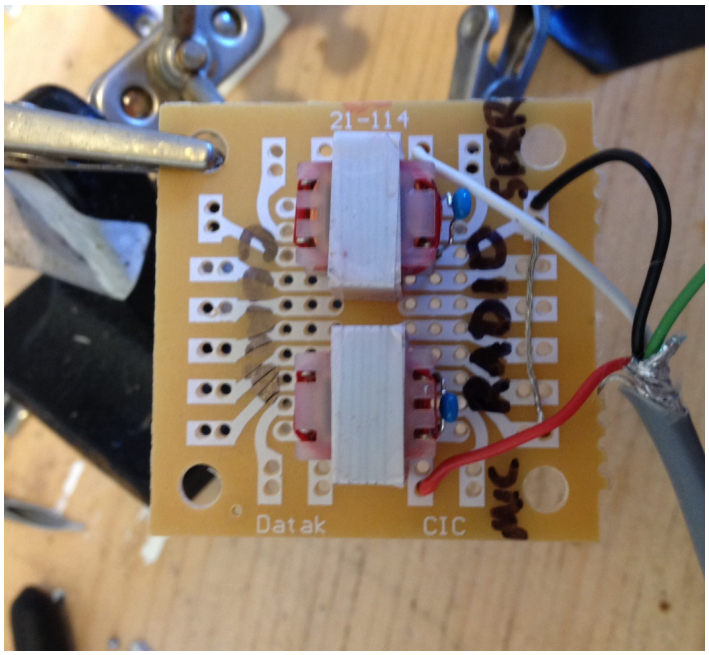
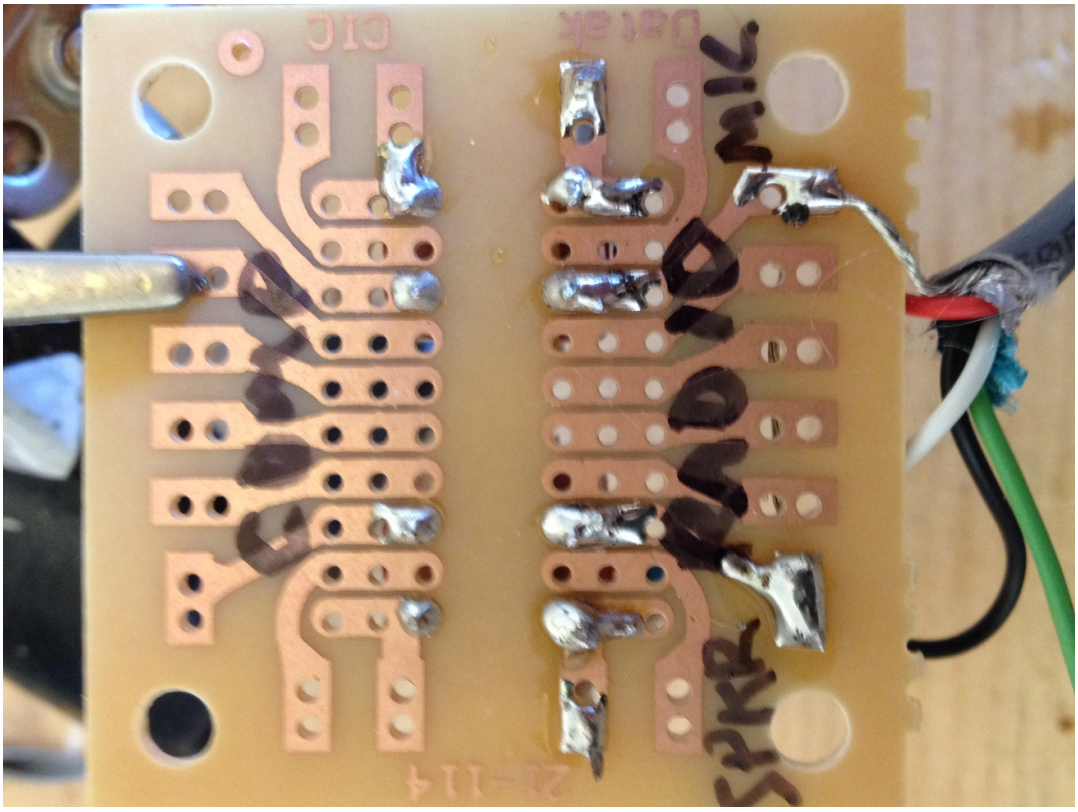
PART TWO $10 TNC CONSTRUCTION PROJECT
AUDIO BOARD AND FINAL ASSEMBLY
November, 2016

Mark the side of the board that will have connections to the RADIO, and the side that will have connections to the COMPUTER. Mark the underside also.

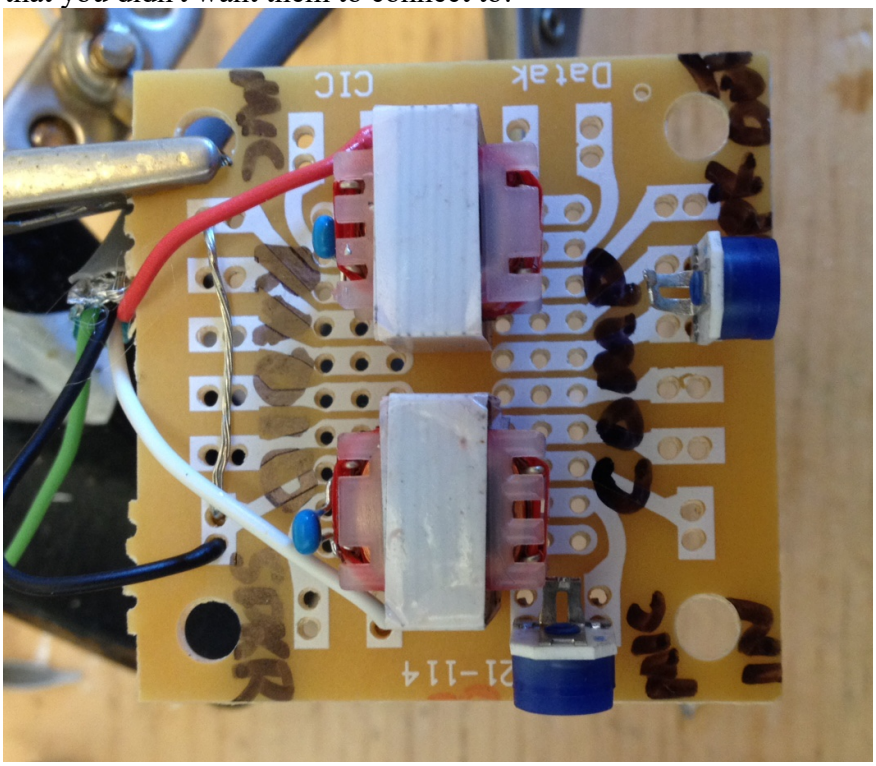
Then mark the radio side that will go to the MIC of the radio (red wire) and the side that will come from the SPEAKER (although it is a white wire in this photo, that is an error -- should be the green wire)

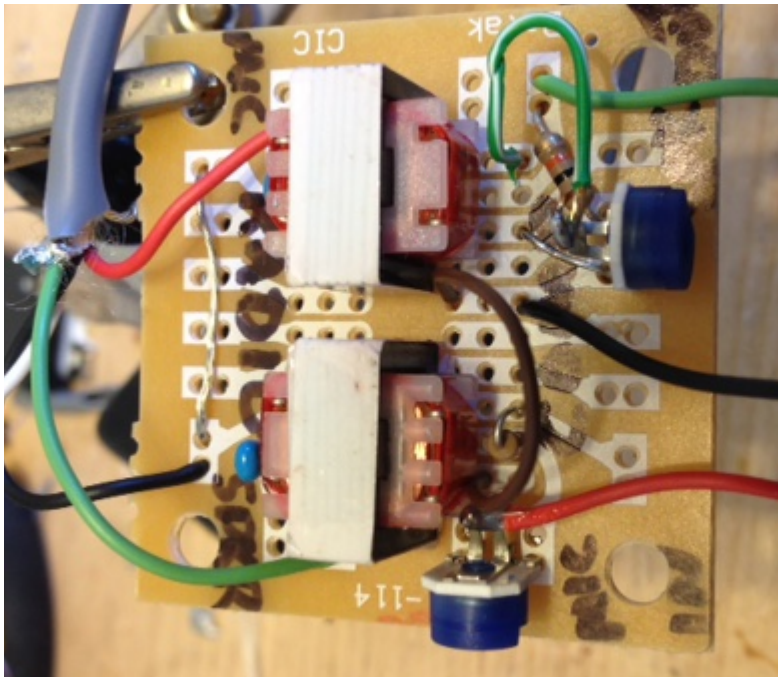
Solder in the transformers and the 0.01 microfarad capacitors and make the connections for the radio wires. The Push to Talk wire (white) will remain unused for now. Note the jumper to allow the ground wire to connect to both transformers.



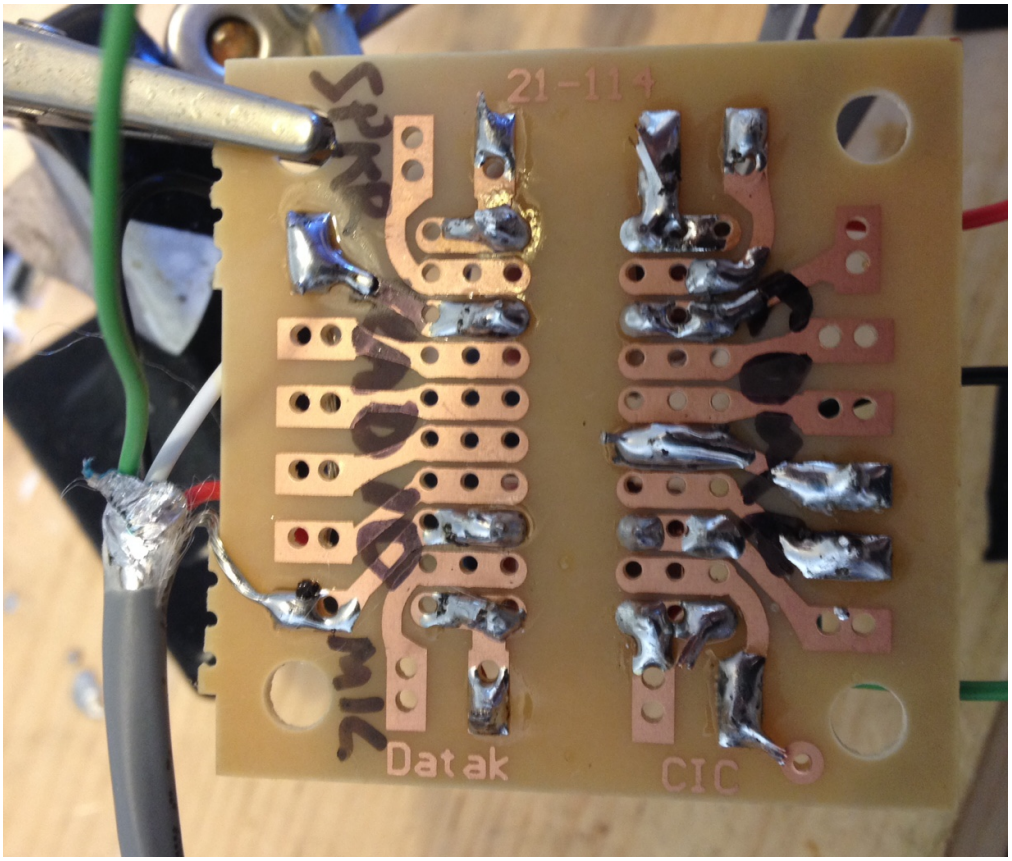

SPKR
GND
MIC

This board layout actually isn't that good for these connections. The 3 pins of the trimmers won't fit because the board isn't drilled on 0.1” centers everywhere. I had to bend the center terminal of the trimmers UP and then I picked these positions for the trimmers to try and make the connections that needed to be made, possible. Be careful not to position the trimmers so that they actually connect to transformer leads that you didn't want them to connect to!

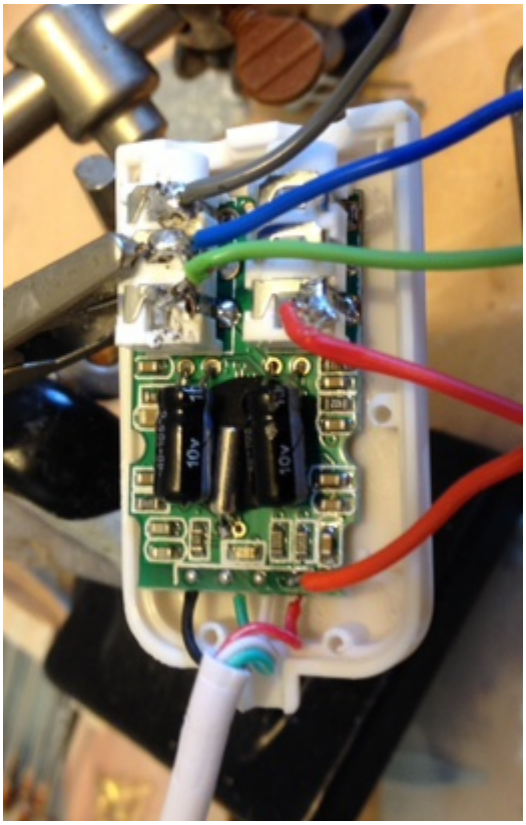




Note the resistors and the jumpers needed to make the required center tap and ground connections.



If you are going to use stereo plug/cables to make the connections to the USB dongle, you won't need this, but if you are going to crack it open and solder directly, here is the photo:



In this photo, the orange wire going near the big white USB cable, is picking off +V from the tiny soldering connection available there. This is a difficult soldering job, be careful. **As an alternative, you can use a second USB cable, just to get to the red and black wires (+v and ground, respectively). This is a lot easier to accomplish mechanically!**

The RED wire on the jack with only one connection, is the mic input wire.

The green wire is the Left Channel headphone output (tip)
The blue wire is the Right Channel headphone output (ring)
The gray wire is the Ground (both DC and AC for the computer side)

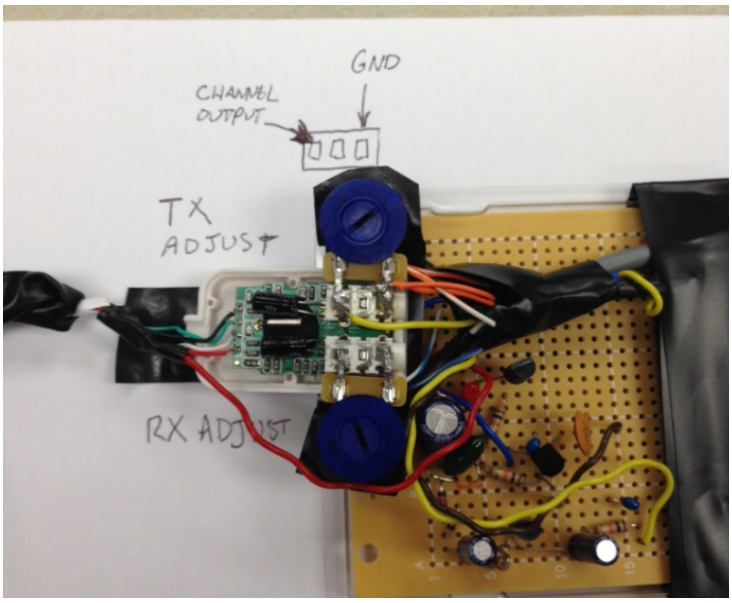
I recommend that you glue the circuit down in the bottom plate after this wiring is done properly. I used 5 minute epoxy and secured the usb wire in the process.

Wiring to the USB audio dongle:

There are four signals you need to connect to.. Using tiny very flexible stranded wire will make this a lot easier. After you get all the connections done and have tested the circuity, I recommend a bit of 5 minute epoxy to glue the USB circuit board back into the bottom half of its clamshell, and a dab on the white cable coming fromthe computer to strain relief it.

- +V (5V DC) which is on the little red wire coming from the USB. You are probably going to have to disconnect that tiny wire, connect to it, and then run a short jumper back to the board. This is tiny tiny soldering so be careful.
- Ground -- easiest picked off of the farthest tab on the audio connectors.
- Audio output from the computer --- from the channel closest to the computer
- Mic input to the Computer (will go to the speaker output from the transceiver) -- from the tab closest to the computer.

The photo below shows an earlier prototype where the audio potentiometer were mounted right on the jacks in the Adafruit Audio adapter, but it shows you where the terminals are that you need to connect to:



On both the audio output (top) and mic input (bottom), the farthest right termimal is ground, and the farthest left terminal is the signal you want. Solder quickly so you don't melt the entire jack and it will work nicely!

Using Stereo 3.5mm Cables
Recommend that you mark which cable goes to the “mic” and “headphone” jacks on the USB dongle. Then use an ohmmeter to discern which wire in your cable goes to which portion of the male plug:

Headphone plug:

TIP =	Left Channel
RING =	Right Channel
SLEEVE =	GROUND, both DC and AC

Mic Plug:

TIP =	mic input
RING	(not used by us, likely the other mic channel input)
SLEEVE =	GROUND, both DC and AC

Wiring to the Transceiver:

There are four signals you will need to connect to the transceiver:

- Mic input
- Speaker output
- Push To Talk control
- Ground

I recommend using shielded wire to run these signals to the transceiver, with the ground connected to the shield at the computer/circuitry side. Leave enough room to put a 2.5" loop a couple of times in this cable to add common mode inductance, and crucially, put a ferrite bead close to the transceiver.

In my station, all cables coming from transceivers terminate in a RF45 wired in the way that would connect to a Signalink which has been configured for their Baofeng/Kenwood connector:

RJ45 Pin	Signal
1	Mic
2	Ground
3	Push to Talk
5	Speaker audio

I choose to wire the cables from my TNCs (the ones that don't have female jacks accepting RJ45 like a Signalink) in the exact same way, and then use a female-female RJ45 compatible adapter to connect TNC to transceiver. This makes it a lot easier for me to "mix and match" different radios and TNCs when necessary.

SOFTWARE

I use UZ7HO soundmodem.exe (the 1200 version, not the high speed 9600 baud version) for packet. This wraps the sound card/ptt circuity and gives it both an AGWPE and KISS tcp interface. Version

0.95 is current as of this writing. http://uz7.ho.ua/packetradio.htm

You can also use MixW for multiple modes, including PSK31 and AX.25 packet. http://mixw.net/ (there may be a charge for purchase).

You can also use FLDIGI with this board for modes that have a continuous audio output such as PSK31 and RTTY. http://www.w1hkj.com/

If the ptt delay is too short, increase the value of C7.

This circuit works well with WINLINK, using UZ7HO software.
http://www.winlink.org/ClientSoftware (see WINLINK EXPRESS download link, lower down the page)

Setting the Volume Controls

If you're using a laptop, be sure to set the volume output to maximum. If you're using a Raspberry PI, see the section below to learn how to use alsamixer to set the volume levels of input and output.

1. Set the RX volume control in the middle of the range where your software properly decodes some normal-sounding beacon or packet station.
2. St the TX volume control (with your computer or Raspberry PI set to 100% output volume) by monitoring your transmitted signal, and setting the TX gain just below the point where the received audio no longer gets any louder.

Setting RASPBERRY PI Audio Gain (Volume) Levels

You'll need to set the mic gain and audio output levels if you're using a soundcard-based technology. If the audio output isn't at 100%, Signalink and similar devices (such as the $10 TNC) may not key the transmitter properly.

```
alsamixer
```

will bring up a “somewhat graphical” volume control. Use Left/Right cursor keys to reach your sound-card device. Use the up/down arrow keys to adjust volume. You probably want the audio output at maximum and the mic gain at 50%.

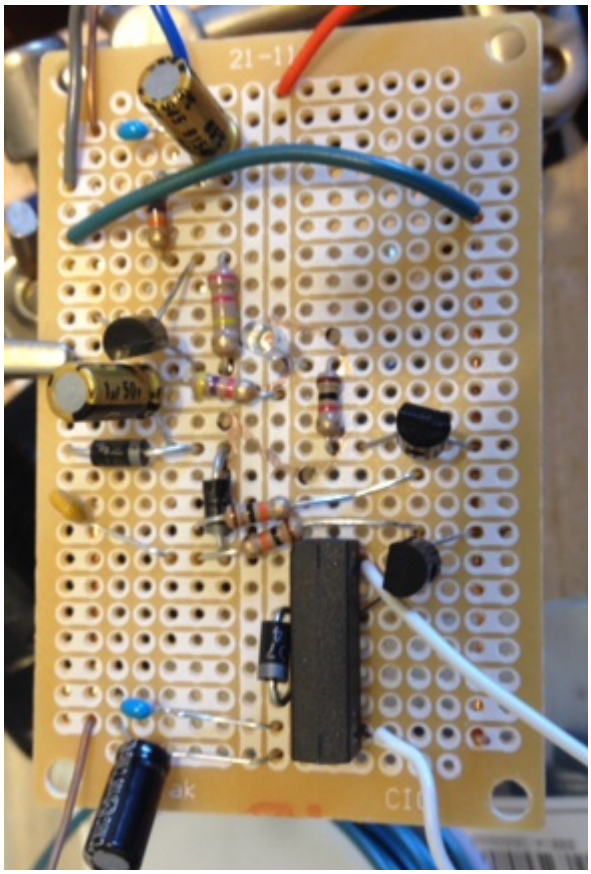
Note that the `alsamixer` works perfectly with the Adafruit USB audio adapter.
(Unfortunately as of this writing, the popular Tigertronics Signalink doesn't interface well with

alsamixer, making adjust of the Raspberry volume levels more problematic.)

After you get your signal levels the way you want them, you'll need to use this command to lock them into place so they remain after the next reboot:

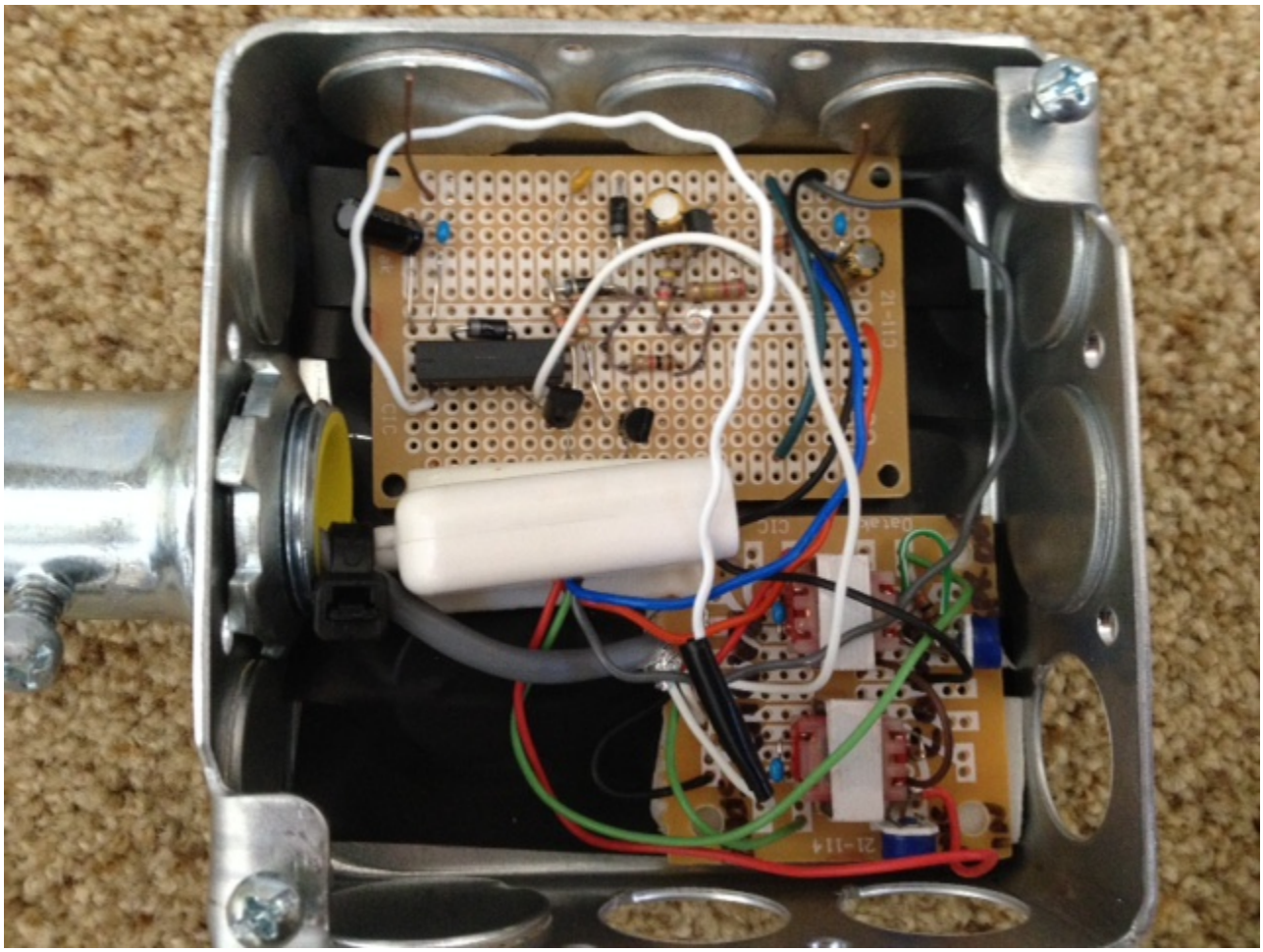
```
sudo alsactl store
```

If you're using a Windows computer, (e.g., with FLDIGI, MixW, BPQ, Outpost or other software) you can adjust the volume controls as with any other windows component.



This shows the relay (with pralleled diode) and drive transistor, and the LED indicator circuit. I had to run a short ground wire on this side of the board (that's the jumper green wire going from the other side's ground to this side. You can see the two 10K reisistors coming from the output of the

rectifier/filter circuitry.



This is the entire circuitry inside an electrical box. One of our members has access to Tea tins, which are about 1 cup volume, and make mounting even easier, because you can double-stick tape to all of the inside walls. A 7/8” wood boring bit is used to cut a hole in the bottom of the tea-tin, and then the electrical sleeve is used to bush the sharp edge --- this could also be done with an appropriate rubber bushing.