MIDI Zeusaphone User Manual

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Team 11

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1. Introduction

This User Manual will guide you through the basic operation of the (MIDI Zeusaphone) project. The project was designed to showcase what students in Iowa State's Electrical and Computer Engineering department are capable of after four years of study.

The main component of the Zeusaphone is a Tesla Coil. A Tesla Coil is a system of power electronics that creates arcs of electricity at high voltage. Our coil is shown below. Overall, there are a number of things to take into account, but as long as people keep a few feet away, things should be fine. Still, PLEASE consult the safety manual for more information.

The Tesla Coil

A Zeusaphone is also known as a Singing Tesla Coil, meaning that it generates arcs of electricity operating at different frequencies to create music. The (MIDI Zeusaphone) has two modes of operation: one through a MIDI Keyboard, and another that allows MIDI audio files to be played. Several songs are already loaded onto the system.

Main steps of operation are as follows:

1. Review Safety Documentation
2. Set up the Tesla Coil and Transmitter
3. Power on Tesla Coil, THEN Transmitter
4. Connect to the web client via WiFi
5. Choose the mode of operation and play music!
6. Remember to stop actions from the web interface
7. Turn off the Transmitter, THEN the Tesla Coil
8. Wait 5 minutes before cleaning up

2. Important Safety Considerations

STOP!

MAKE SURE YOU UNDERSTAND THE SAFETY CONSIDERATIONS

A disregard for safety can cause bodily harm or property damage. The Zeusaphone spouts arcs of electricity operating at high voltage which can shock nearby people or damage electronics. As long as people are aware of the safety and stay more than a few feet away, there should be no problems. However, always consult the safety manual to be sure. There are some notable exceptions.

People with pacemakers or other electronics on their bodies should be more cautious than most. Although the arcs may not touch a person, an electromagnetic field can disrupt something like a pacemaker which would be deadly. When running the Zeusaphone, make sure anyone who may have a situation like this is aware of the safety concerns and proper precautions are taken. When in doubt, these people may need to leave the room with the Zeusaphone for their own safety.

Damage to other electronics is a more likely issue. Make sure the Zeusaphone is not within a few feet of any other electronics and that anyone getting close to it does not have a personal device on them. The Zeusaphone will be fine, but nearby electronics could be fried. Generally, people can be closer than electronics should be.

Once there is an understanding of what can be a potential danger, the Zeusaphone will be a safe and fun demonstration!

3. Setup

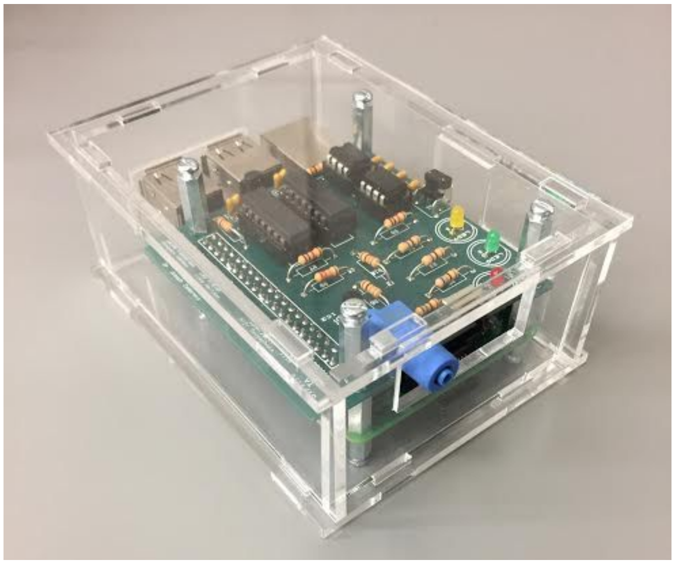


Figure 1: Transmitter

The transmitter is what sends signals to the Tesla Coil. It is controlled through the website, described later.

Figure 2: Tesla Coil

A large case that contains the Tesla coil circuits and the coil itself. Do not get too close to it while it is running!

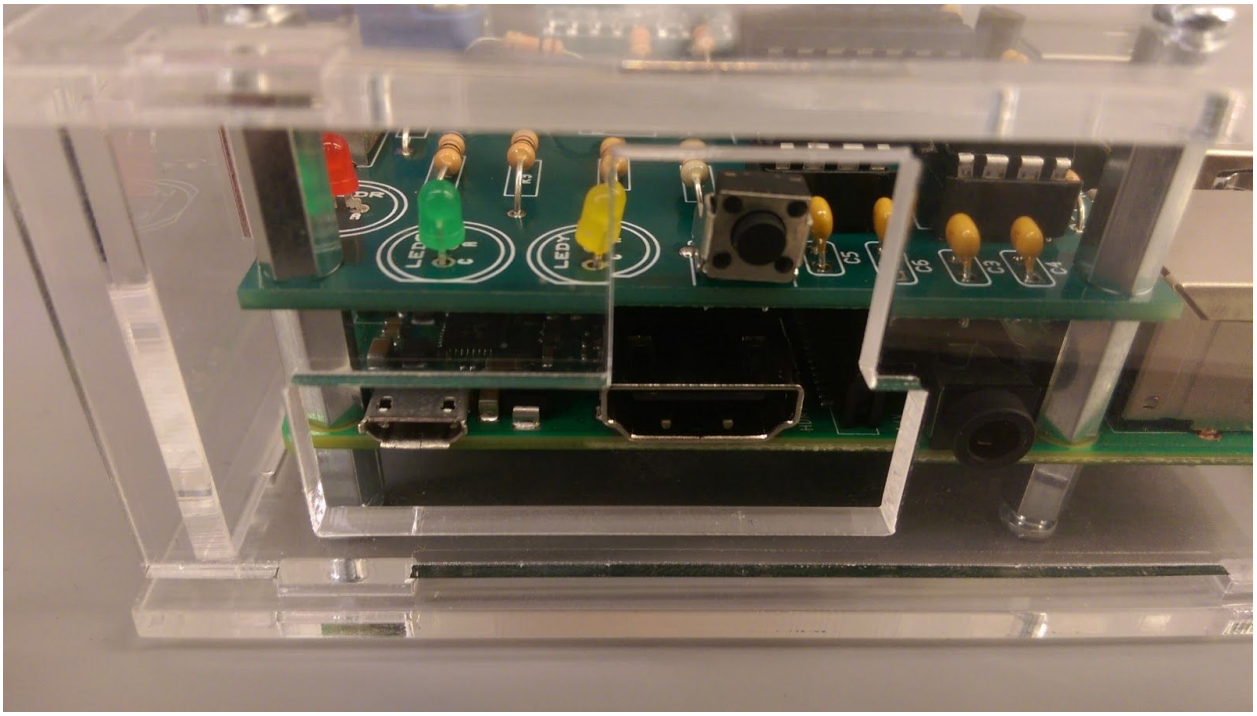
The breakout point, indicated on the photo, is where sparks will arc out of. Point this away from anything that can be harmed by the arcs.

3a. Moving the coil

Be extra cautious when moving the Zeusaphone from storage as it is slightly top heavy. Only ever pick up the coil from the bottom and NEVER grab it by the secondary coil (the cylinder wrapped in wire).

3b. Setting up the system

1. Physically set up all pieces so the transmitter (controller) is at the full length of fiber optic wire. Nothing should be plugged in yet.
2. Plug in the fiber optic wire to the coil first, then the transmitter, and tightly screw in each end. If you are confused, consult section 7b.
3. With the power strip switched off, plug the tesla coil into the power strip first, and then the power strip into the wall.
4. Plug in the transmitter to power it on. Do not start playing anything while the coil has no power.



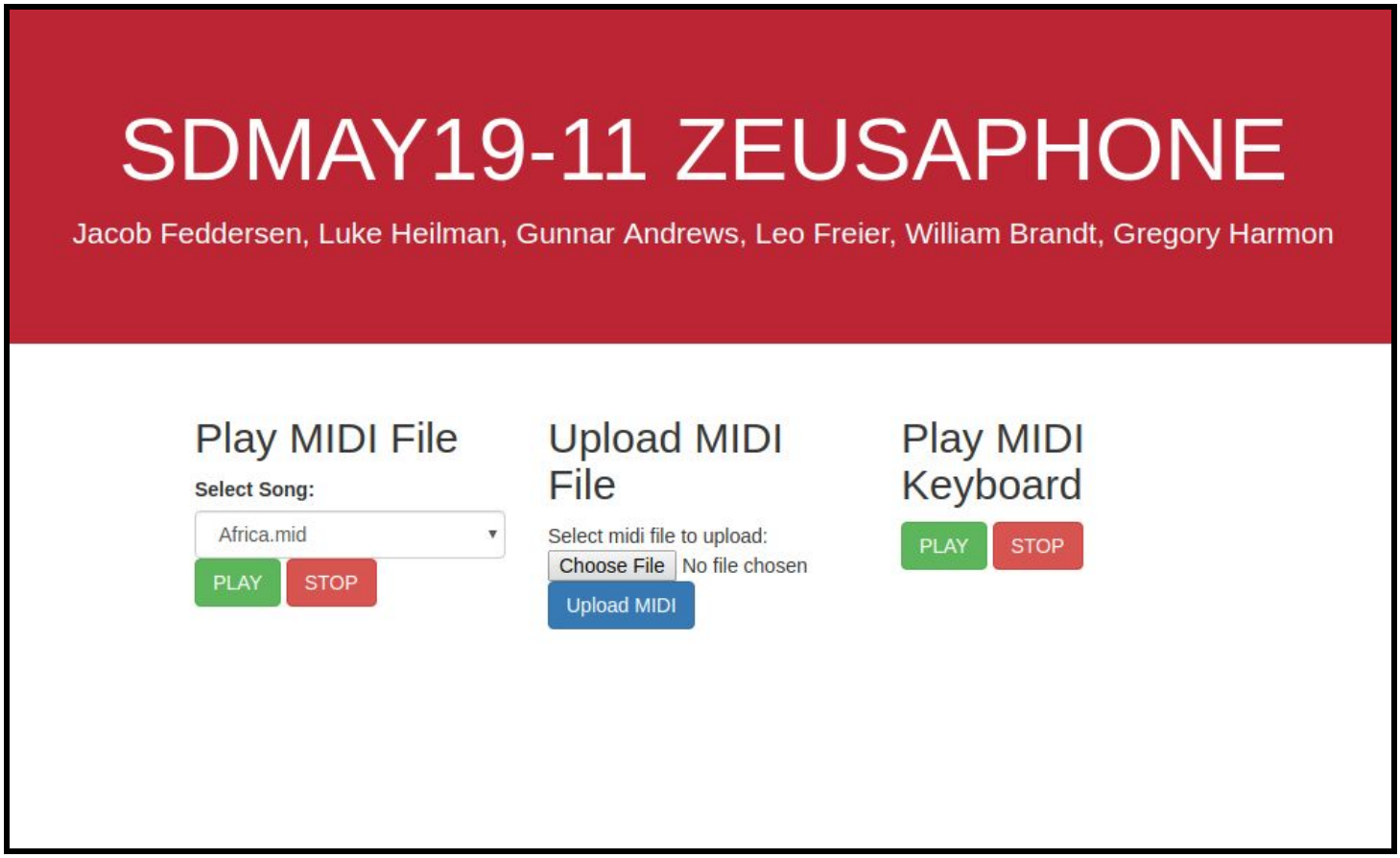
The Power Plug-In on the bottom left

5. Connect to the website.

6. Before playing anything, power on the coil by turning the power strip on. The red power light at the base of the coil should illuminate. It is safer to turn on the coil just before use to ensure that all other steps are done properly.
7. Play something through the website!

3c. Connecting to the website

The coil is controlled through a locally hosted website. Once the transmitter is powered on, connect to the WiFI network named "**ISU Zeusaphone**" with the password "**sdmay19zeus**". Then, navigate to the website "**192.168.4.1**" and the interface should appear. If the WiFi network does not appear, wait until the green LED lights up on the transmitter. Any device that can connect to the WiFi network will work, namely a smartphone or laptop.



The website for controlling the Zeusaphone

4. Basic Operation

Playing a song or starting the keyboard while either function is already enabled is safe and will not result in strange or unexpected behavior. While the yellow LED is lit, no action can be started without first stopping the current action.

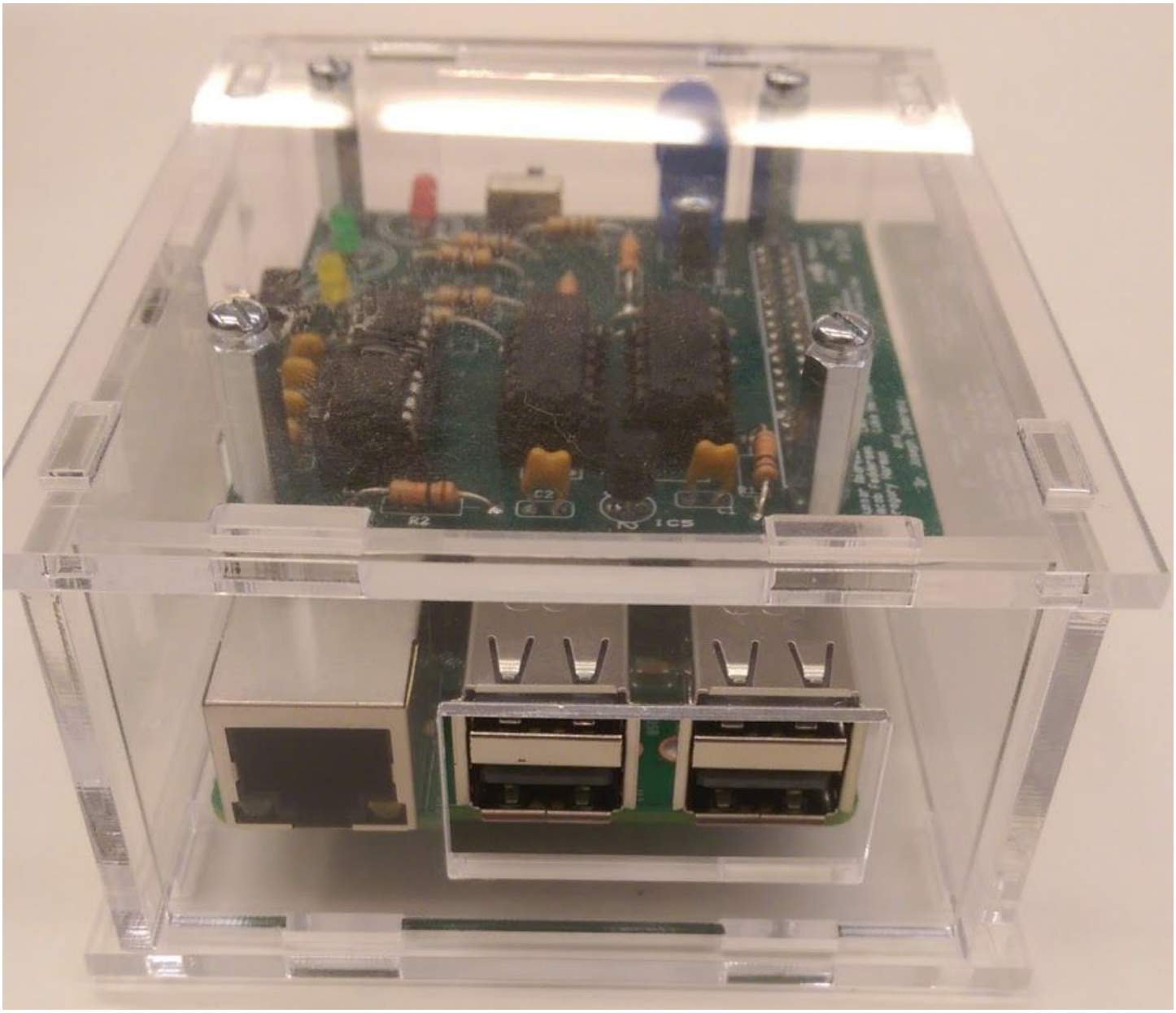
Note that sparks will arc from the copper wire on top of the system, known as the breakout point. Make sure it is secure and pointed away from anything it can harm before operating.

4a. Playing MIDI Songs

Select a MIDI song from the list on the web interface (the left side). Then hit the play song button. Songs can be stopped with the stop song button, otherwise they will play out and another action can be started.

4b. Playing with a Keyboard

Plug the keyboard into a USB port on the transmitter. Enable the keyboard by pressing the start keyboard button on the web interface (on the right side). Until the stop button is pushed, the keyboard will take input and play up to two notes at a time (due to limitations of a tesla coil). Make sure to stop the keyboard on the website when done.



Transmitter USB Ports

4c. Loading MIDI Songs

MIDI songs can be loaded onto the transmitter. Simply select the load MIDI button on the web interface (in the middle) and select a file to be uploaded. Only MIDI files, .mid or .midi files, will be able to be loaded. Then, songs will be added to the list of available songs. The Zeusaphone can only play two channels at a time, so some songs may not sound right if the melody

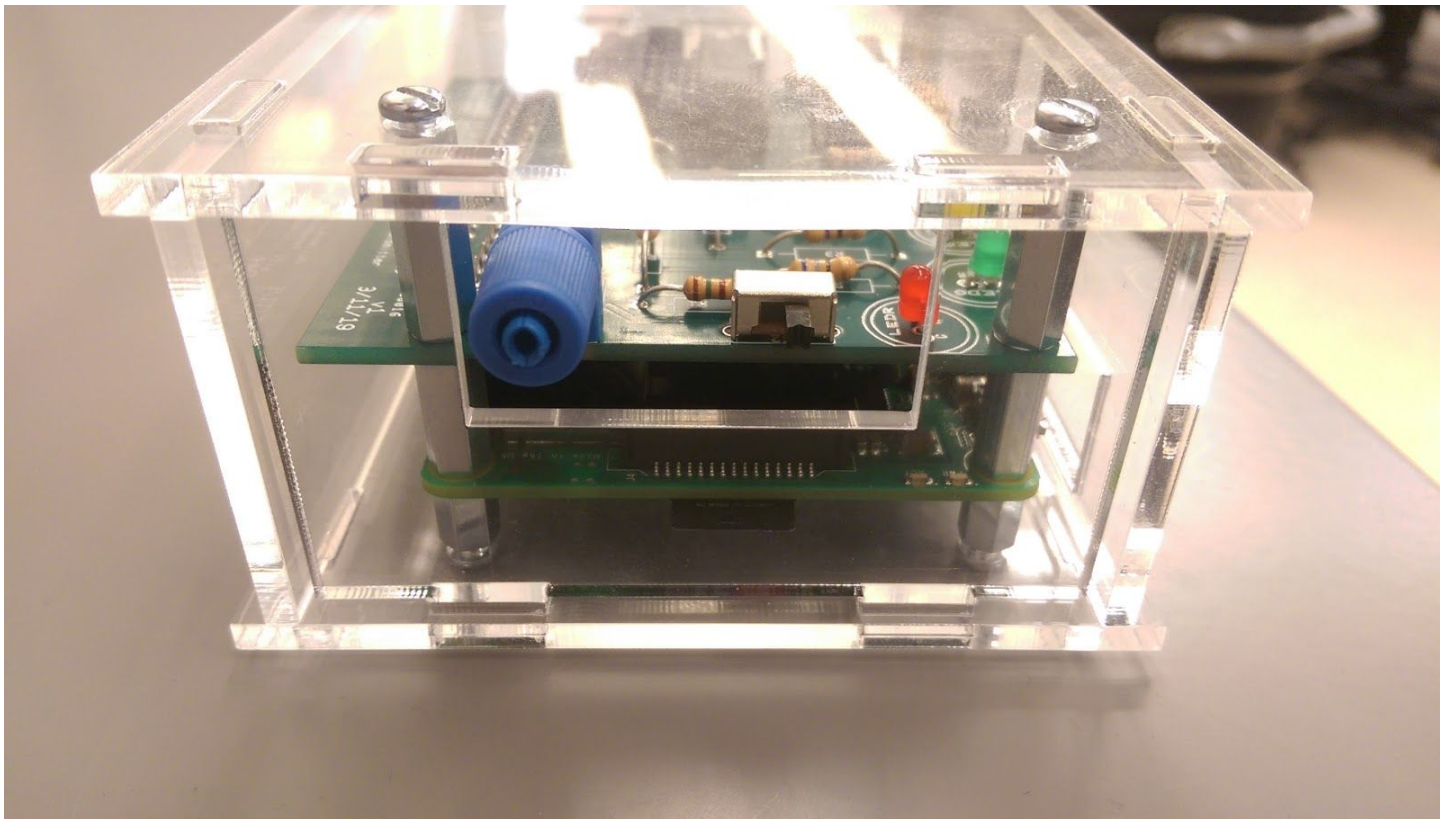
bounces between multiple channels. Two channel MIDI files can probably be found online if you want to look for them.

5. If something goes wrong while operating...

1. Disable the fiber optic transmitter by moving the switch on the transmitter.
2. Shut off the coil by unplugging it.
3. Follow section 6 to finish powering off and cleaning up the system.

6. Powering Off and Cleaning Up

1. Turn off the Transmitter *first*. Slide the switch on the front of the transmitter to the off position, and then press the button on the side of the transmitter case. Wait about 10 seconds after the LEDs shut off (the red power LEDs will remain lit), then unplug the transmitter power.



The fiber optic port and switch

2. Power off the Tesla Coil by unplugging it.
3. After the Tesla Coil is powered off, wait 5 minutes for the energy stored in the main capacitor to discharge. Touching the coil before the capacitor discharges can lead to receiving a large electric shock.
4. Disconnect the fiber optic cable from both the transmitter and the Tesla Coil.
5. Put away all of the items. Again, make sure to only grab the Tesla Coil from the bottom of the case. Do NOT pick it up by the secondary coil (the large column of wrapped wire).

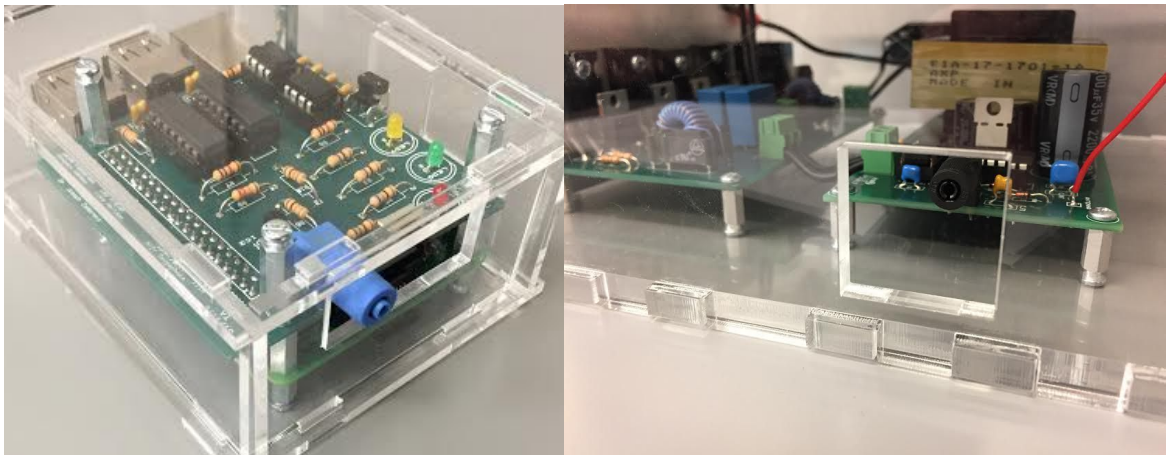
7. Troubleshooting

7a. If a note is stuck while playing the keyboard

This is a known bug that happens because of too many conflicting MIDI messages. Nothing is broken, simply play more notes and the stuck note should switch off.

7b. How to plug in the fiber optic cable

Both the transmitter and the coil case have a fiber optic connection to communicate. They are blue and black, respectively, small cylinders that need to be unscrewed (loosened) first, before plugging in the thin, black fiber optic cable. Then, tighten the connection around the cable. It should be a tight connection, but there is no need to force it.



Pictures of the blue transmitter and black receiver .

7c. If the breakout point falls off

The breakout point can easily fall off, but is also easily reattached. The flat end of the breakout needs to be secured under the bolt on top of the coil. Screw the bolt just enough so the breakout point is contacting both the bolt and the surface under the bolt. Be careful not to screw the bolt too tight, as the surface might collapse.

If the breakout point falls off during operation, immediately power off the transmitter, and then power off the coil. Wait at least 5 minutes before approaching the coil and reattaching the breakout point.

7d. If nothing is happening

Of course, there are a variety of potential problems.

1. Check connections - power, fiber optic, and USB to the keyboard.
2. Check that the fiber optic switch is on - nothing will output from the transmitter if it is off.

3. Check the fuse of the coil. If the small wire inside the glass fuse case is burned and split in two, the fuse will need to be replaced. It is generally obvious if a fuse is blown or not.

4. Check the LEDs on the transmitter. Red is for power, green is for ‘ready’, and yellow is when the transmitter is transmitting. If there is a yellow light but no results, check the fiber optic connection.
5. Check the website, and make sure you’ve selected to play a song or to enter keyboard mode. Try stopping the input and trying again.