

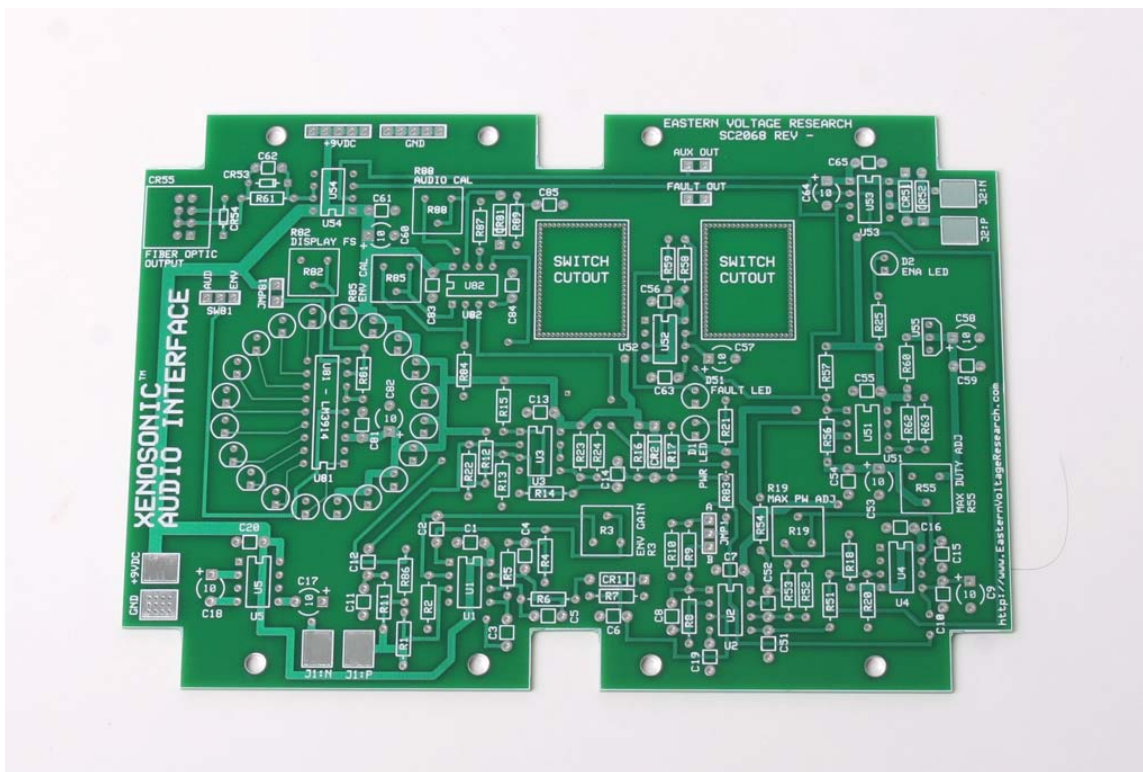
XenoSonic Audio Interface Specification



XenoSonic Audio Interface (shown with Front Panel)

The XenoSonic Board Kit contains the PCB board required to build the XenoSonic Audio Interface system. This board has been professionally designed and thoroughly tested to ensure maximum performance.

[Click here to visit the ordering page for this board kit](#)



XenoSonic Audio Interface Board

6.5" x 4.0" x 0.062"

Double-sided

FR-4 Laminate, 1 Oz. copper (1.25 Oz. after plating)

RoHS Lead Free

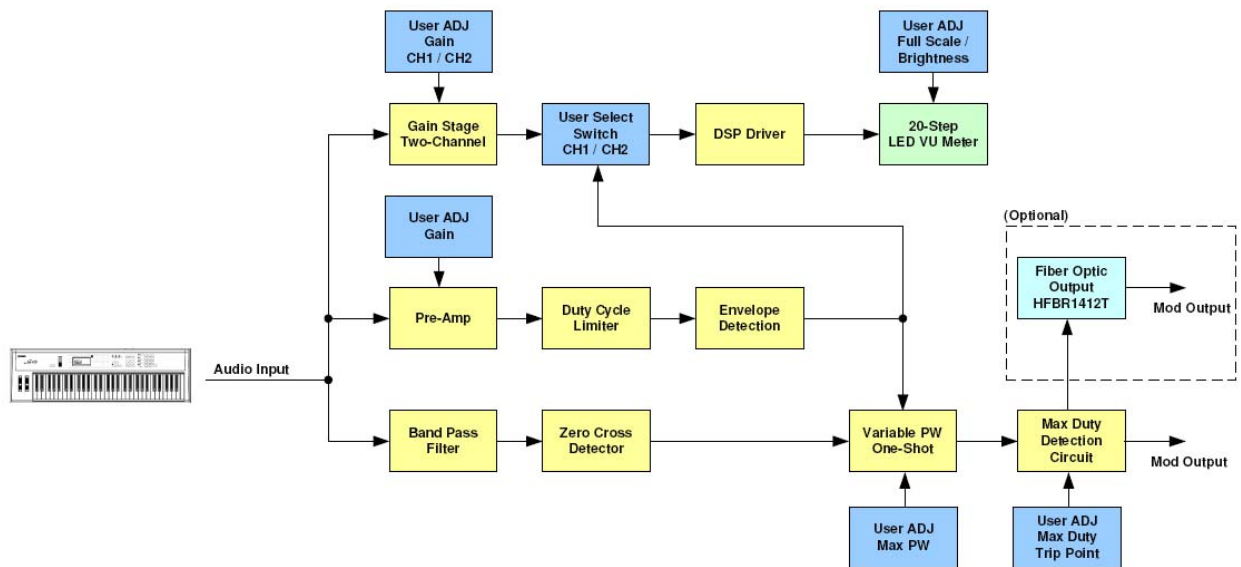
Silkscreen / Soldermask

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EQUIPMENT WARNING:

DRSSTCs in general put out intense electromagnetic fields and have the capability to induce currents on anything metallic in the vicinity of operation. This includes wires, cables, and nearby electronic devices.

For this reason, we do not recommend the use of portable (non-grounded) battery powered devices for input sources. This includes cell phones, MP3 players, walkman's, battery operated CD players, laptop computers, etc... Use the output from AC powered devices only and ensure both the XenoSonic and audio device is at least 20 feet away from the DRSSTC or other Tesla device. Also, ensure that the devices being used are properly grounded.



The XenoSonic Interface is an advanced analog interface board which allows one to connect almost any type of monophonic audio source to either a VTTC, SSTC, or DRSSTC. Whether you are a trumpet player, a guitar player, or a keyboardist, you can connect the XenoSonic to your instrument and have your Tesla coil reproduce the audio tones that instrument is playing in real time. In addition, it can also be hooked up to other audio sources such as the sound card outputs of a computer, a CD player, or even some of the more obscure instruments like a vintage 1950's Theremin. The only restriction being that the source should be monophonic.

Features:

- Custom Designed to fit with the SERPAC S-172 plastic enclosure
- Adjustable Envelope Gain (How much pulsewidth is varied vs. input volume)
- Adjustable Max Pulsewidth

- Fiber Optic Interface output (if required, otherwise leave unpopulated)
- Onboard +5VDC and -9VDC power regulators
- Duty Cycle Foldback Limiting (Duty cycle automatically limits as input freq increases)
- Max Duty Cycle protection circuit (User programmable)
- 20-Step LED Bar Graph Display (Used to show audio input and setpoint feedback)

Operational Specifications (see notes 1,3)

Audio Input	Voices Frequency Range Low Pass Filter 3dB Nominal Input Range Max Input Voltage	Monophonic 50Hz to 5kHz (tested) 5kHz (tested) 0.0 to 2.0V P-P 9.0V
Output Specification	Output High Output Low Minimum Pulsewidth Maximum Pulsewidth Fiber Optic Transmitter Fiber Optic Connector Type	Vbattery (9.0V nominal) 0.0V 25us (see note 2) 500us (see note 2) HFBR1412T (Avago Technologies) ST connector
Duty Cycle Protection	Duty Cycle Foldback Minimum Duty Cycle Maximum Duty Cycle	0% 25%
Input Power Requirement	Minimum Voltage Maximum Voltage Nominal Voltage (as tested)	7.0V 12.0V 9.0V (9V battery)
Battery Type		Standard 9V Battery

Notes:

1. All specifications above are based on the default circuit values used in the schematic. All parameters are fully user customizable to whatever pulsewidths, duty cycles, frequency, the end user requires for their specific operational use.

2. Assumes maximum voltage input at 500Hz (Pot R19 varied from low to high)

3. Depending on individual component tolerances, actual values may be slightly different than what is listed in this table.

Basic Operational Instructions

Note: The instructions below will get you to a working initial conditions. However, fine tuning will be necessary after these instructions are followed to get to an optimal working condition.

1. Determine and/or measure the voltage range of your audio input source using an oscilloscope (or similar) You should determine what the voltage level is for nominal volume, and also what the voltage level is for maximum volume.
2. Using an audio oscillator (such as an HP 200), or signal generator, drive the audio input with the nominal voltage you measured or calculated in step 1 above. Set the frequency to 500Hz sinewave.
3. Using a multimeter to measure the voltage across R10, adjust R3, envelope gain, until you get a value of approx. 7.0 volts with the signal generator set according to step 2 above. This sets your nominal envelope gain at 500Hz, which is the frequency no duty cycle foldback is occurring.
4. Now increase the amplitude of the signal generator to the maximum voltage you determined in step 1. Using an oscilloscope to monitor the output pulsewidth as measured across R20, adjust R19 to the maximum pulsewidth your particular Tesla coil system can operate at.

SPECIAL NOTE: *If the pulsewidth at R20 when R19 is turned fully clockwise, is considerably greater than what your system can support, then you may need to change the value of C15 and/or R19 to reduce the pulsewidth. Failure to do this may damage your Tesla coil system.*

5. Measure or calculate what the maximum duty your Tesla coil system can operate at safely and reliably. The maximum duty cycle number will be used to set the maximum duty cycle limit.
6. Using a multimeter, measure the voltage across C53, and adjust R55 until the desired voltage trip limit is set. The table below shows what voltage trip point corresponds to which duty cycle. (Note: This can also be done using an input voltage source. Simply set the input voltage source, and output pulsewidth, to the maximum duty cycle you want the system to operate it. Then adjust R55 until the Fault LED trips.)

R53, Gain Resistor	Max. Duty Cycle	Voltage across C53
24.3k	25%	5.00V
	20%	4.00V

	15%	3.00V
	10%	1.98V
	9%	1.77V
	8%	1.59V
	7%	1.39V
	6%	1.20V
	5%	0.99V
	4%	0.80V
	3%	0.60V
	2%	0.40V
	1%	0.20V

Note: These numbers are gross approximates only. Actual duty cycle trip point will vary depending on individual component tolerances, frequency of operation, etc... If maximum duty cycle setpoint is critical, then additional testing shall be required to determine actual setpoint.

7. To calibrate the onboard VU meter, first decide if you want just a visual indication of the audio input, or a quantitative indication of audio performance.

The first step is to calibrate the VU meter for 9V full-scale voltage. Connect a 9V supply directly to the input of the LM3914. (JMP81 should be open at this time) Adjust R82 until all LEDs are illuminated. This will set a full-scale voltage of 9V. Actually, you set this for any voltage you wish up to the datasheet's maximum rating. Some may choose 10V fullscale if they truly want 1V per LED.

VISUAL INDICATION

Simply, put SW81 in the position to feed the audio input into the LM3914 IC. Now, using your instrument as an input, adjust R88 until maximum volume input from your instrument illuminates all 10 LEDs. Do the same with SW81 in the position of ENV. This time adjust R85.

QUANTITATIVE INDICATION

Instead of hooking up an instrument, use a signal generator to input a waveform of know amplitude / frequency. Then adjust R88 and R85, as before, to ensure 1V (or whatever the fullscale voltage / 10) per step division is accurate per the actual waveform input.

For additional information on calibrating and tuning the onboard VU meter, please refer to *National Semiconductor LM3914 datasheet*.

8. If your device requires a fiber optic interface, there is an onboard fiber optic interface circuit. It typically is not used (or populated), but in the event it is needed, simply install C60, C61, U54, CR53, R61, C62, CR54, and CR55. CR55 is the fiber optic transmitter and is designed for an Avago Technologies (formerly Agilent / HP) HFBR1412T. There are several variants of the device with different connector types, so use the one which is most compatible. These are low cost and available through most electronics suppliers.

9. Finally, once all settings are properly set, double check output waveforms and duty cycle trippoints to ensure proper operation before hooking up to your Tesla coil system.

Disabling Duty Cycle Protection

To disable duty cycle protection, simply remove U2 and U51. Pull-up resistor, R57, will maintain a high level at the ENA inputs of U53 and U54.

Modifying Duty Cycle Foldback Control

R5 and C3 form an RC filter which forms the basis for the duty cycle foldback control. This works by decreasing the volume envelope as input frequency increases, thus reducing duty cycle as frequency increases. R5 and C3 form a low pass filter with a cut-off frequency at approximately 237 Hz. The cut-off (3dB) frequency can be changed by modifying the value of R5 according to the equation below:

$$F_{\text{cutoff}} = 1 / 2 * \pi * (R5 * C3)$$

Disabling Duty Cycle Foldback Control

To disable duty cycle foldback control, simply remove C3.

Disabling Volume Envelope Pulswidth Control

Volume envelope pulswidth control can be disabled by simply removing R9, R10, and C9.

JMP1

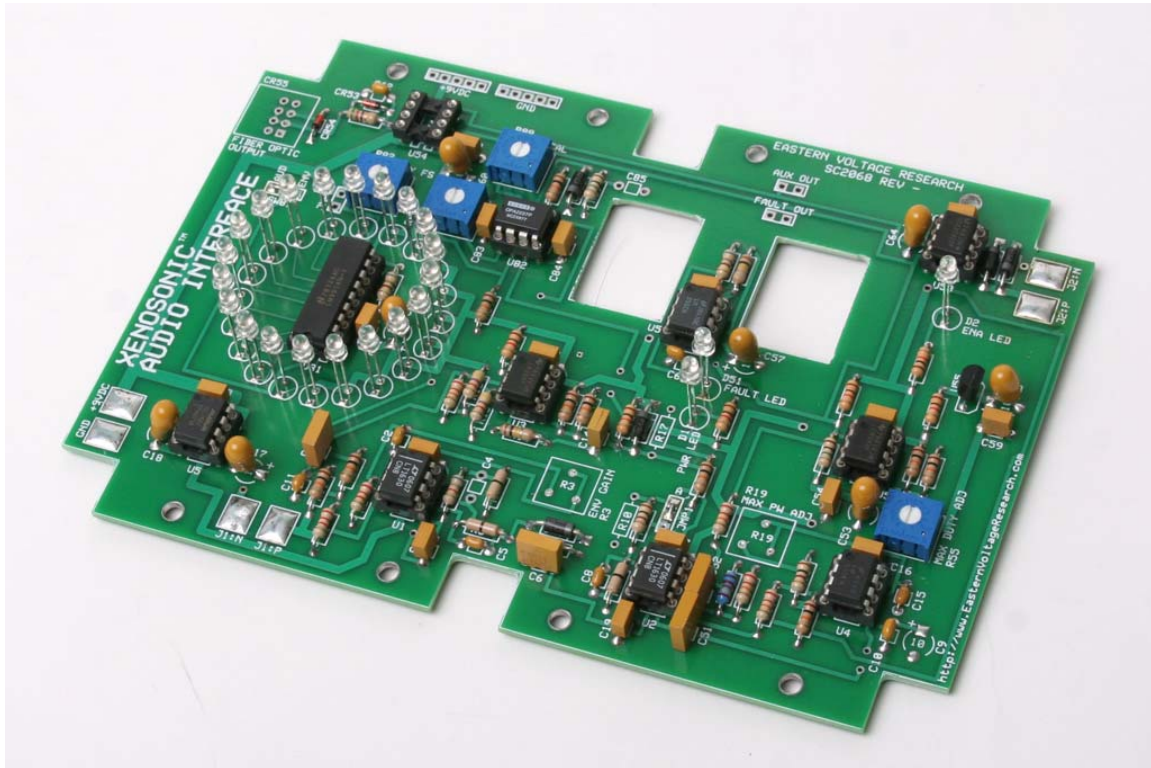
Jumper 1 is used to select which voltage to use as the sample voltage for the 10-step LED display. As R10 is not used for general use, JMP1 should always be connected at the "B" end of the jumper.

Advanced Programming

1. R11 and C11 set the audio input low pass filter. This filter is used for high frequency noise suppression. This can be customized (or even removed) at any frequency desired.
2. R11 and C12 work together to form an audio high pass filter, although its mostly used to AC couple the audio input from the rest of the circuit. This can be set to any desired value as well.
3. R4, R5, C3, and C4 are used to set the duty cycle foldback limiting circuit. The duty cycle foldback limiting is basically employed by using a 2nd order active low-pass filter. As frequency increases, the gain decreases, thereby decreasing the amount pulswidth will vary with input audio amplitude. And as a result, limit duty cycle to prevent overpowering of your Tesla coil. The schematic, as shown, uses a 1st order roll-off filter. However, R4, and C4 can be installed with the appropriate R and C values, to change this to a steeper 2nd order roll-off filter.
4. R12, R13, and R22 can be set to other values to set the minimum trip point for the zero crossing detector. As is, the sensitiviyy is about 5mV.
5. R58 and C57 set the duration of the D51, overduty LED. Each time a fault is detected, this LED will illuminate. The default value is approx. 1 second.

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Construction Notes



XenoSonic Board with all components installed

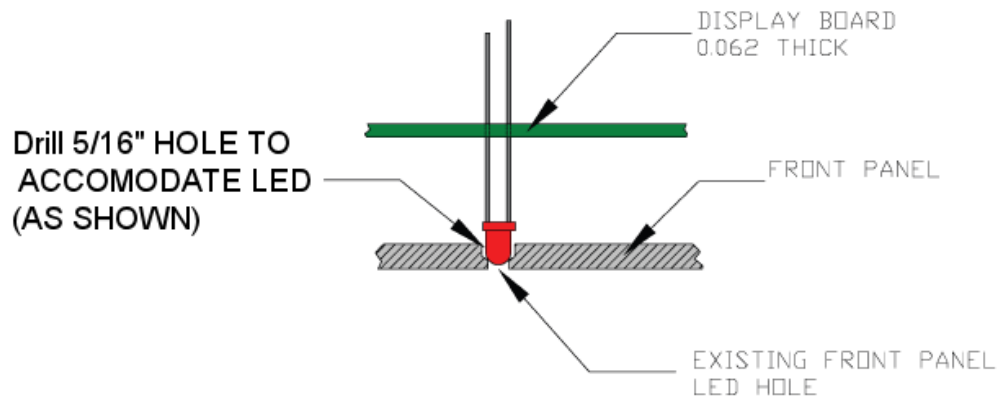
1. Cut out the two pushbutton holes as indicated in the PCB board.
2. Build the Xenosonic PCB board according to the parts list and schematic. Do not install LEDs or the potentiometers R3, or R19. R3 and R19 will be installed directly to the front panel, and not to the PCB board.

3. Install 0.250" length stand-offs in the PCB mounting bosses on the enclosure upper section as shown below. First, tap each existing mounting boss to 6-32 thread. Then add a drop of cyanoacrylic (Super) glue to each mounting boss hole. Screw in each 6-32 x 0.250" stand-off.

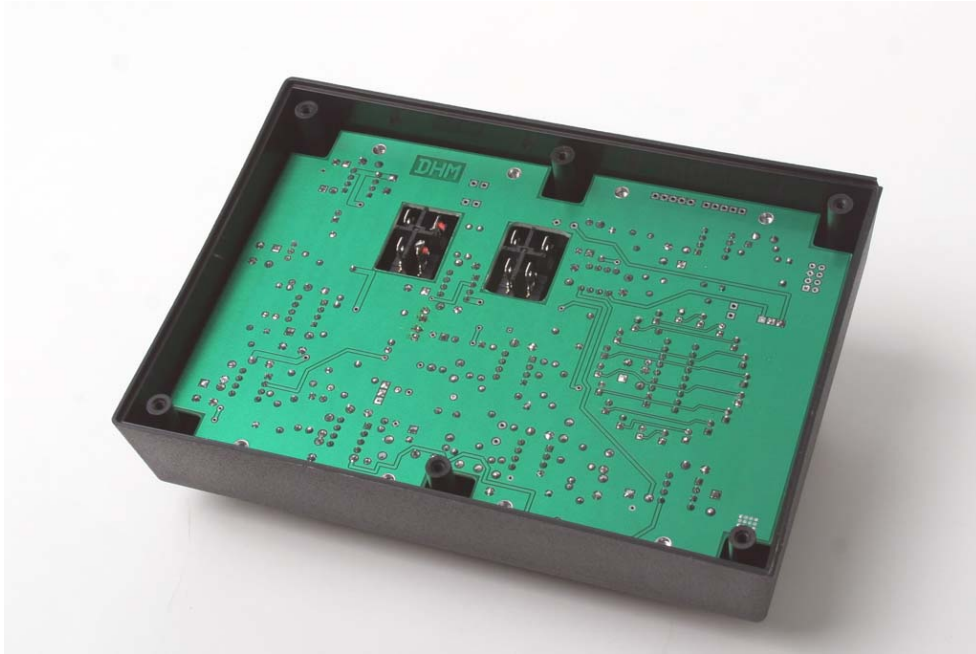


Upper Enclosure Piece with 6-32 x 0.250" stand-offs installed

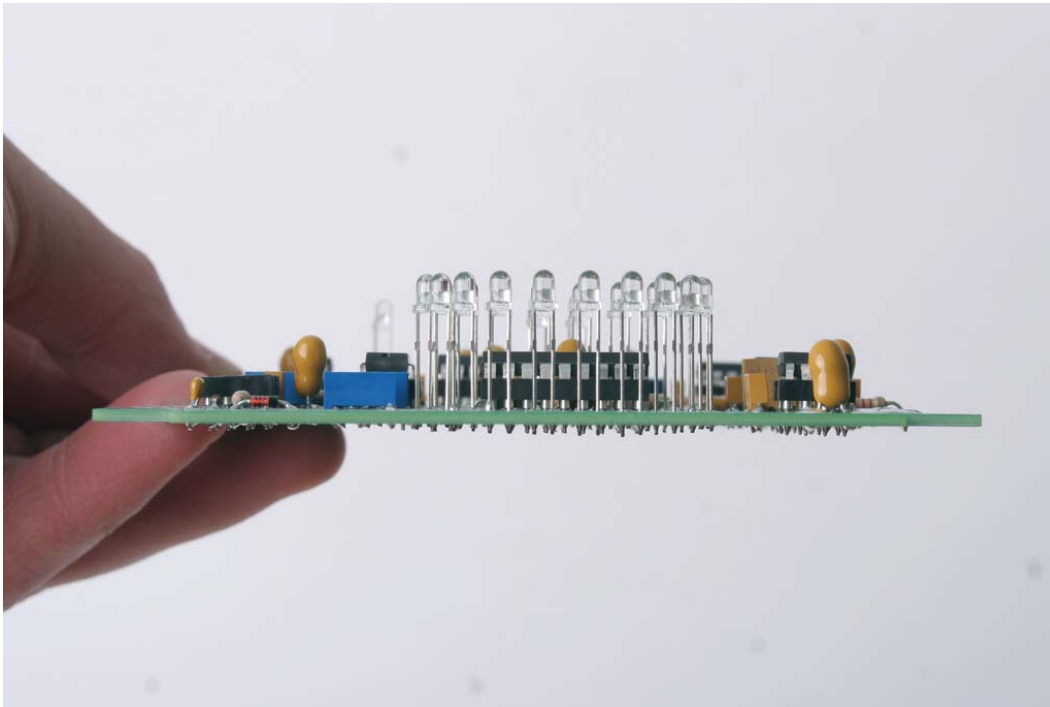
4. Prepare the Xenosonic front panel plate LED holes as shown below using a 5/16" (or similar) drill bit. DO NOT drill through entire panel! Only enough to provide the LED with enough room to positively secure into the front panel, but not through. Cut a rectangle in the top of the enclosure to accommodate all components (LEDs, pushbuttons, potentiometers), and install the front panel using 8-32 machine screws.



5. Install all LEDs (DO NOT solder) into the PCB board. Mount the PCB (with LEDs) to the upper enclosure. Position the LEDs so they are installed in each of their respective LED holes. Then solder each LED. This will ensure each LED is the proper length. MAKE SURE the polarity of the LEDs is correct!!!! The long lead of the LED is the ANODE!!!!



***XenoSonic Board placed on stand-offs in Upper Enclosure
(Note the switch rectangular holes)***



Sideview of XenoSonic Board showing LEDs mounted at correct height

6. Install potentiometers, R3 and R19, and switches into the front panel as shown.



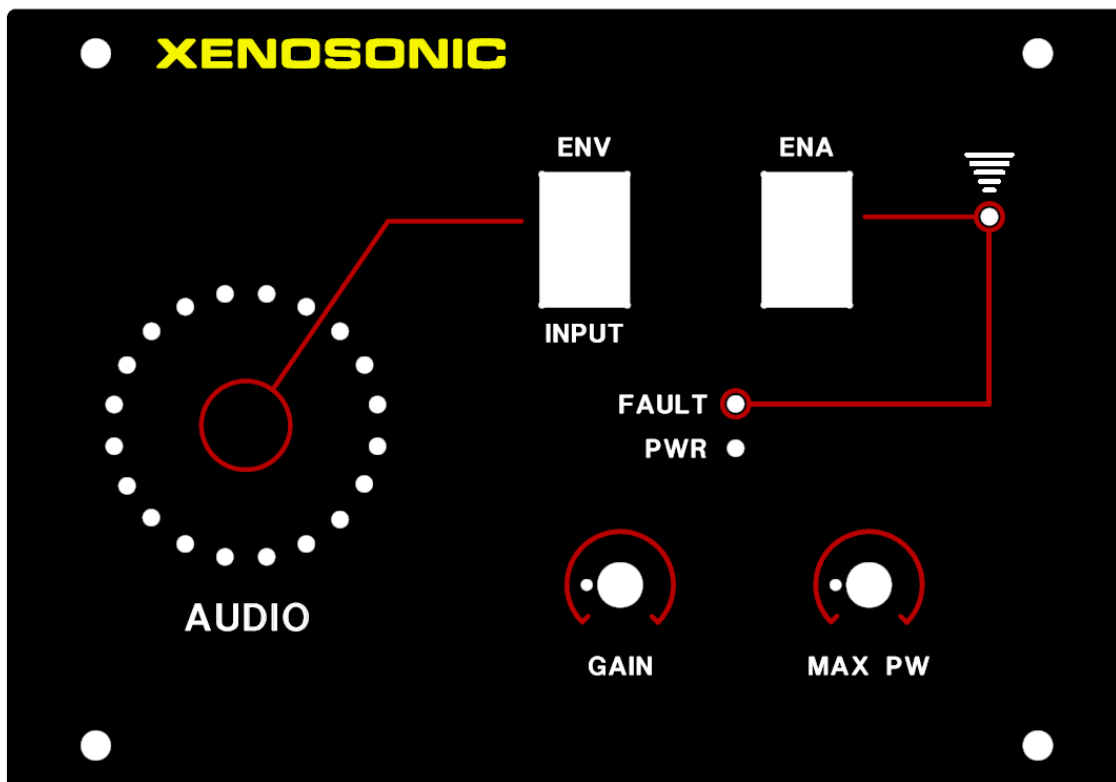
7. Complete the wiring per the schematic for the enclosure. The 9V battery holder can be glued directly to the base, and the BNC connectors installed through the bottom portion of the enclosure.



Bottom Enclosure with 9V Battery Holder / BNC Connectors

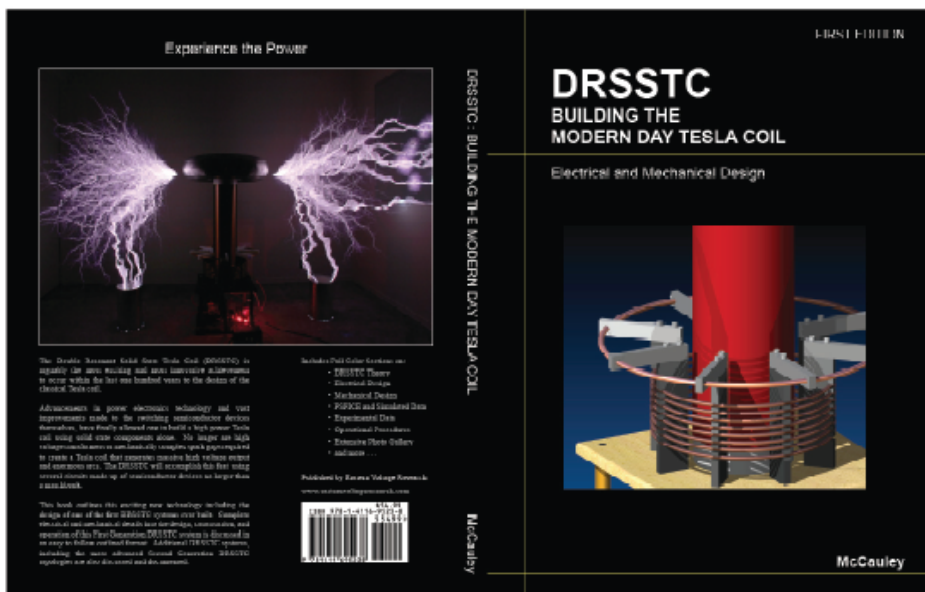
8. Test the board as necessary to ensure proper operation.

XenoSonic Audio Interface Front Panel



The custom designed XenoSonic front panel adds that professional touch to your Tesla Coil controller. This front panel is compatible with the parts (switches, LEDs, potentiometers) as defined in the parts list for the XenoSonic audio interface.

[Click here to visit the ordering page for this front panel](#)



FEATURES

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