

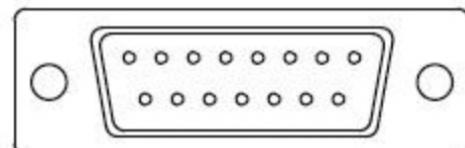
Control Box V2.0



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NNC/UFMG – 2019
Brazil



01	grey	Bar 1
02	purple	Bar 2
03	blue	Bar 3
04	green	Bar 4
05	yellow	Bar 5
06	orange	Bar 6
07	red	Bar 7
08	brown	Bar 8
09	NC	x
10	NC	x
11	NC	x
12	blue	Arduino 5V
13	green	Arduino GND
14	brown	V 220 VAC +
15	red	V 220 VAC -

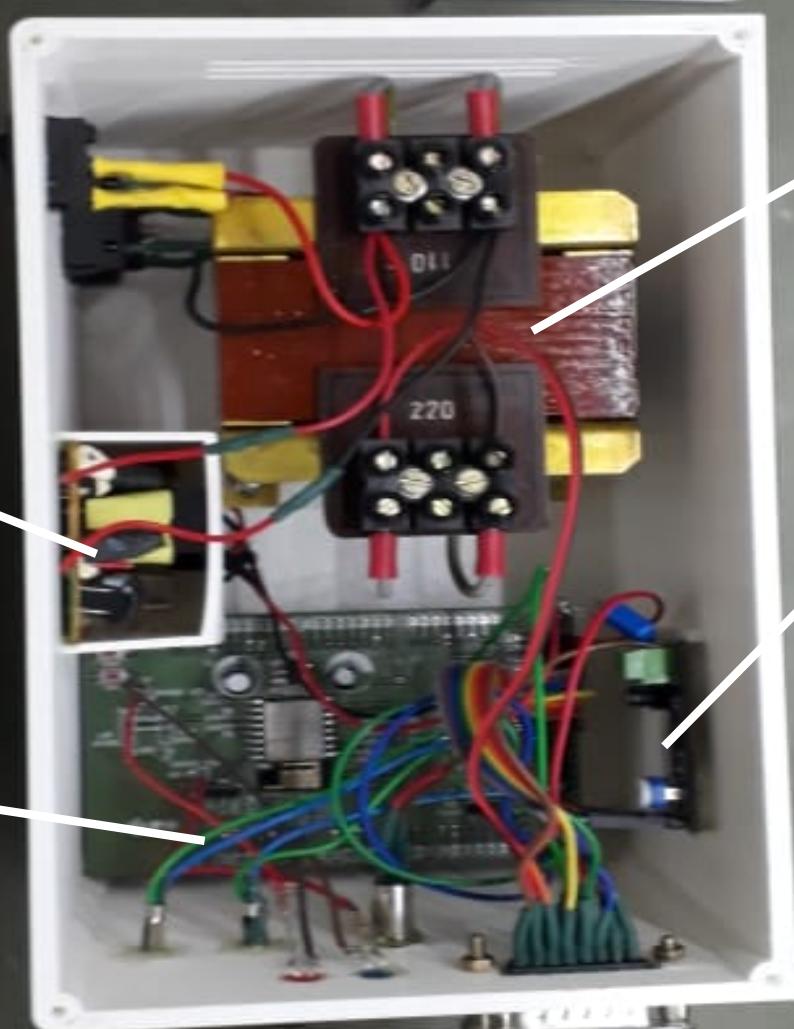


01 02 03 04 05 06 07 08
09 10 11 12 13 14 15

DB 15
Bars Control



Tweeter



Power Supply
12V 2A

Control Board
Arduino DUE
Shield ESP8266

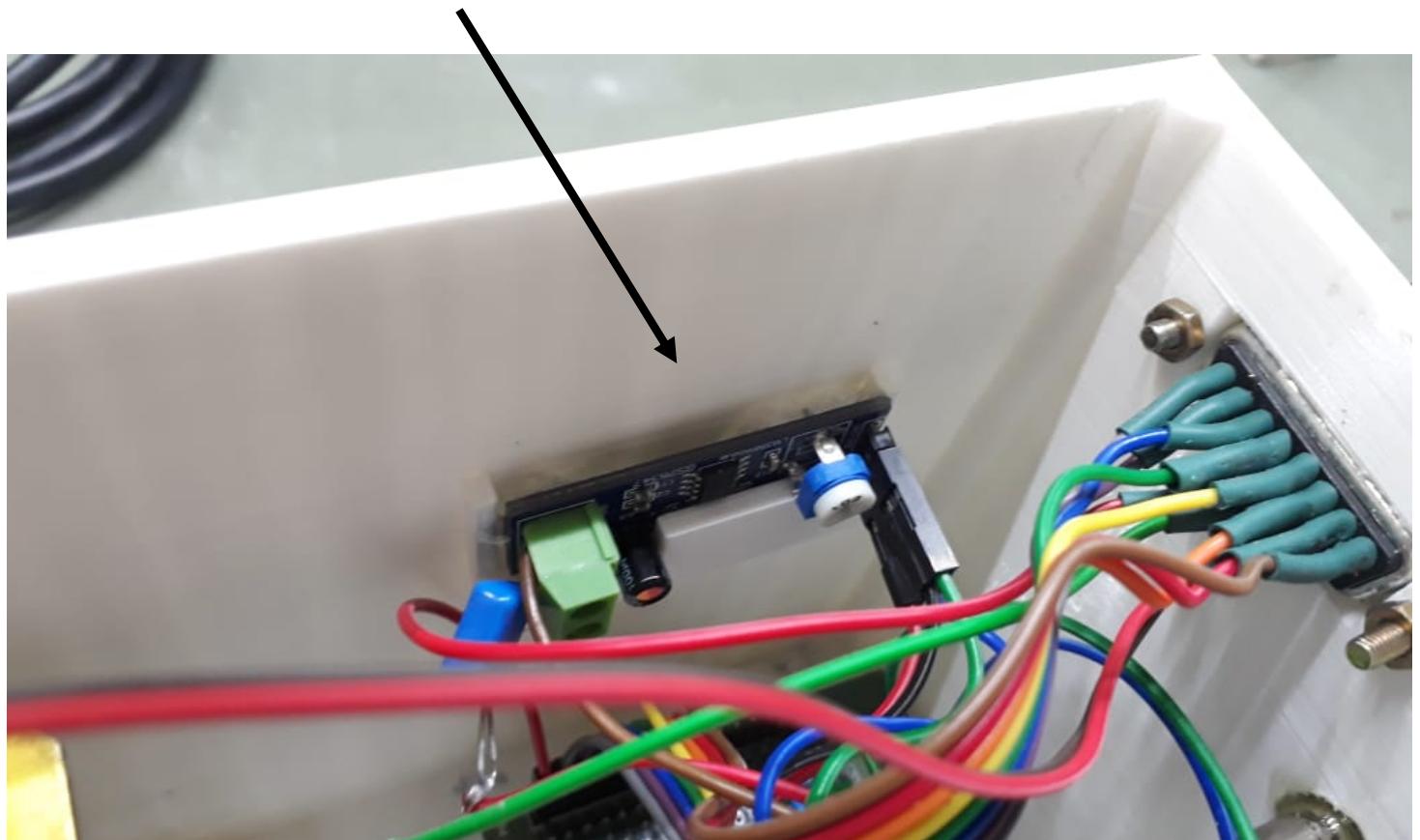
Isolated
transformer

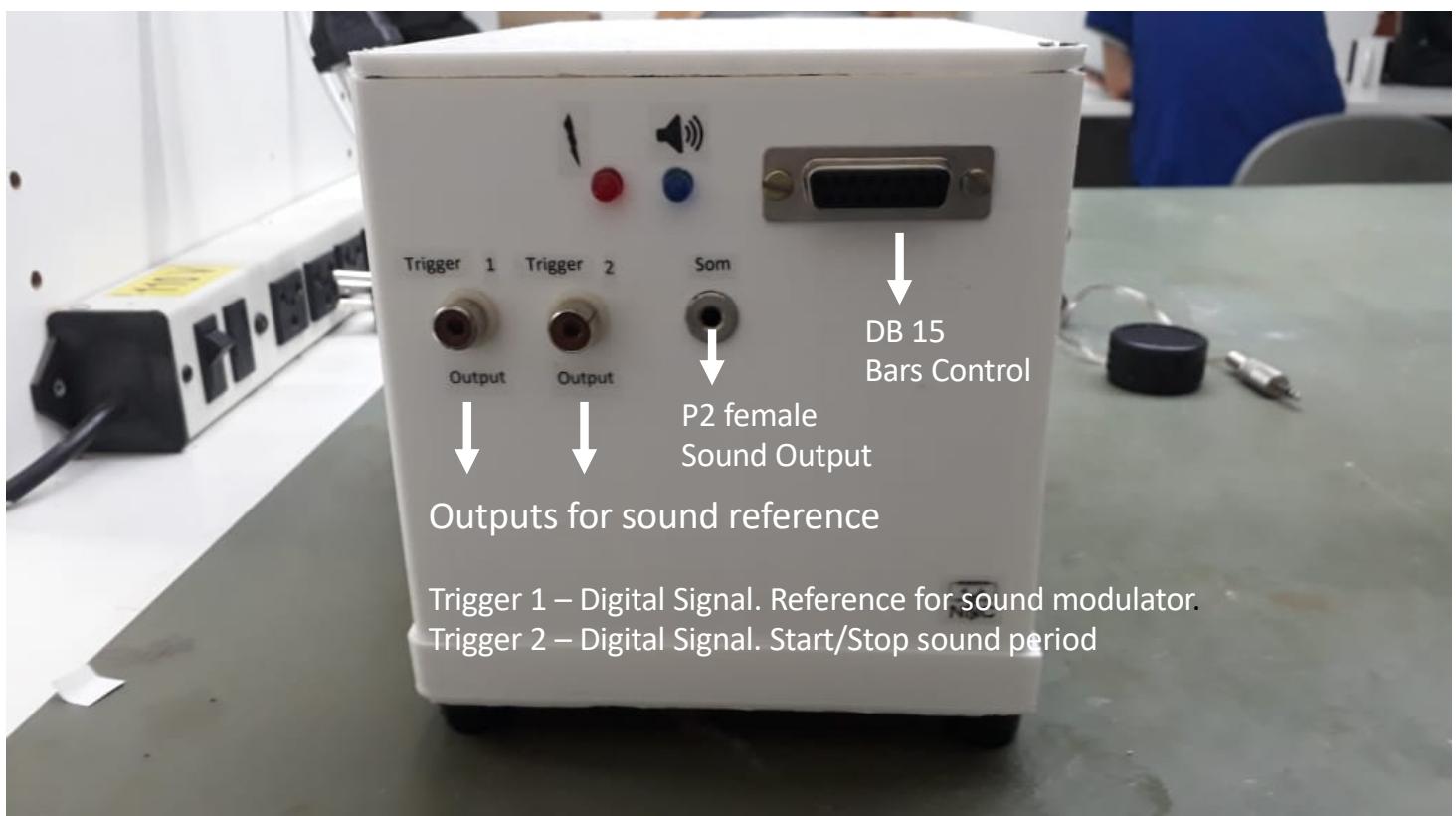
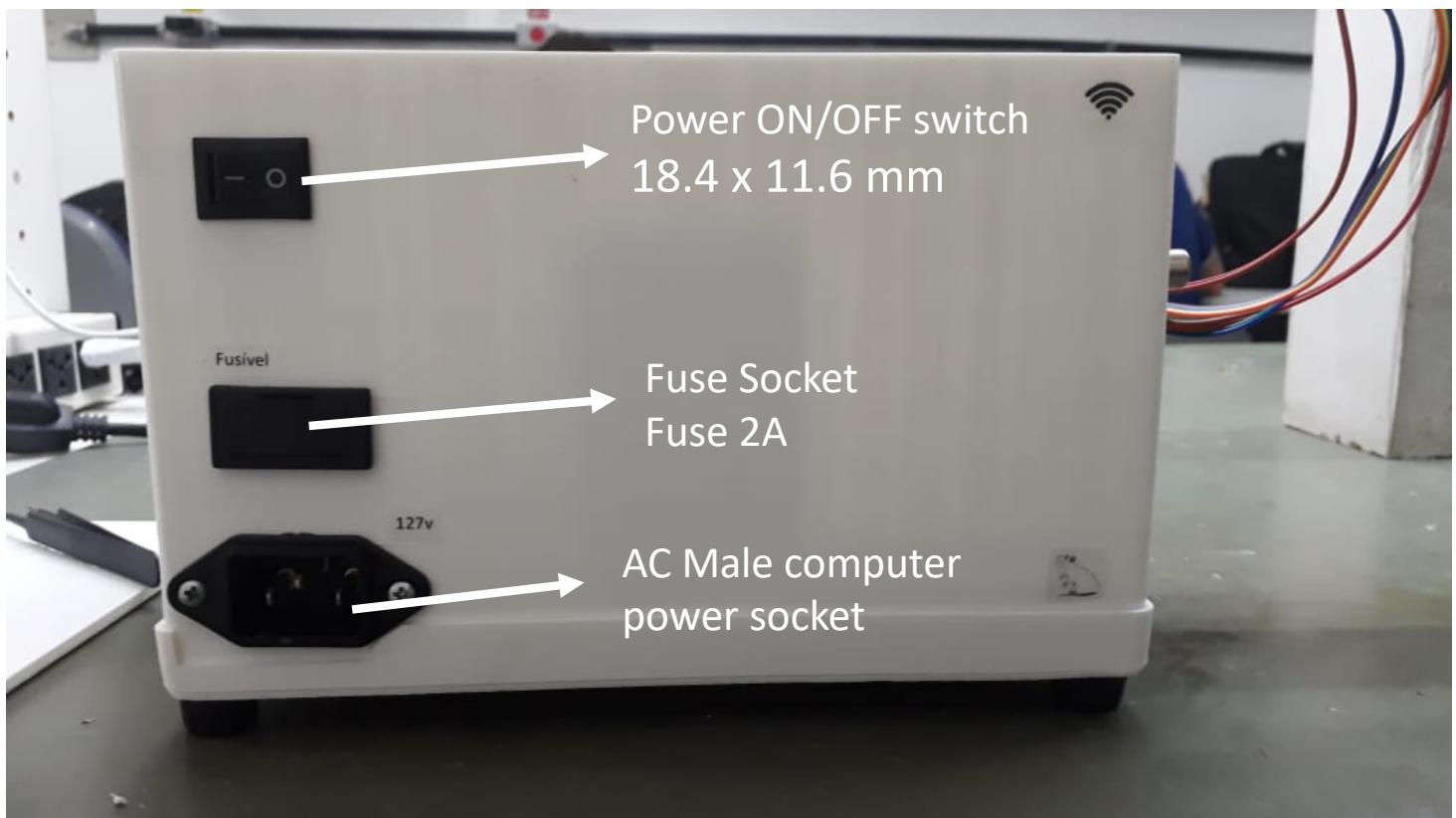
Audio Amplifier
LM386

Audio Amplifier

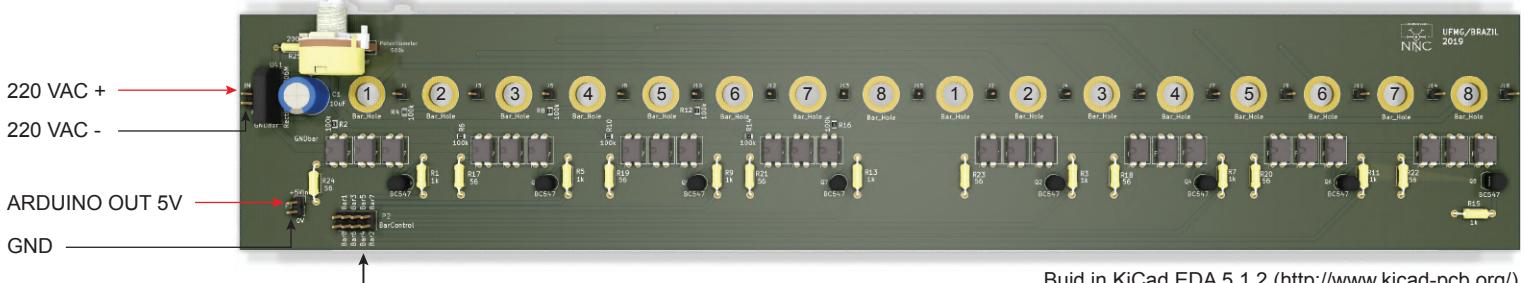
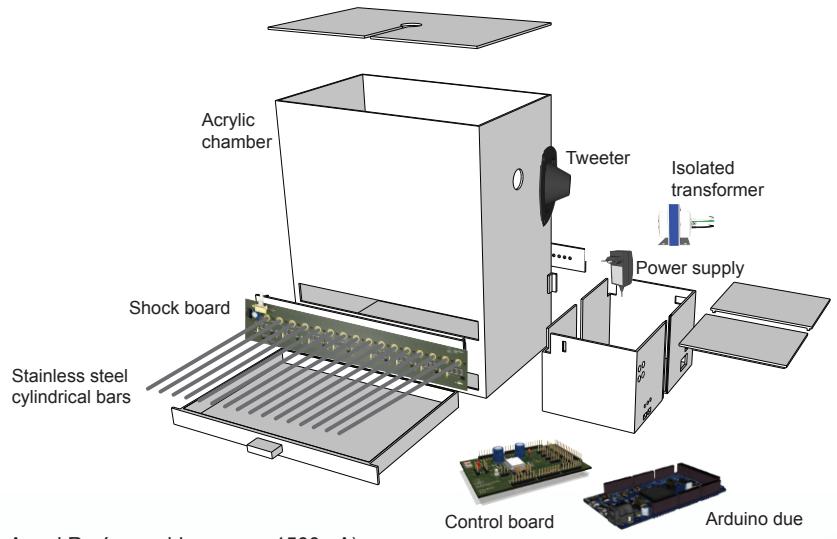
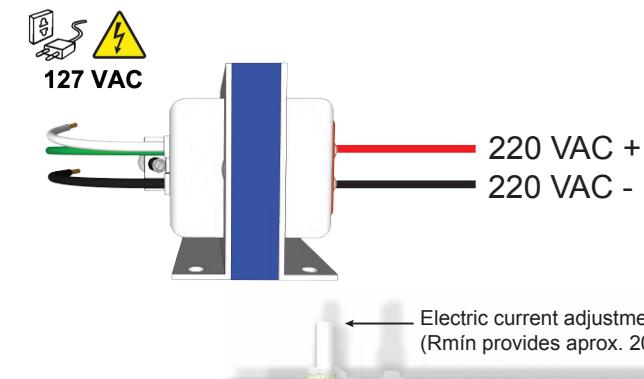
LM386

<https://www.amazon.com/5V-12V-Amplifier-Module-Arduino-EK1236/dp/B01FDD3FYQ>

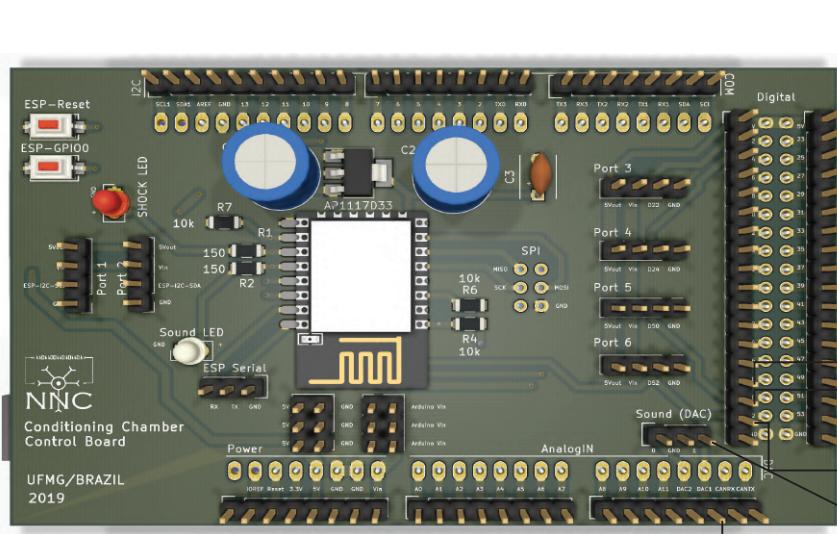




Assembly Instructions



Buid in KiCad EDA 5.1.2 (<http://www.kicad-pcb.org/>)



OUTPUT BARS / PULSE CONTROL

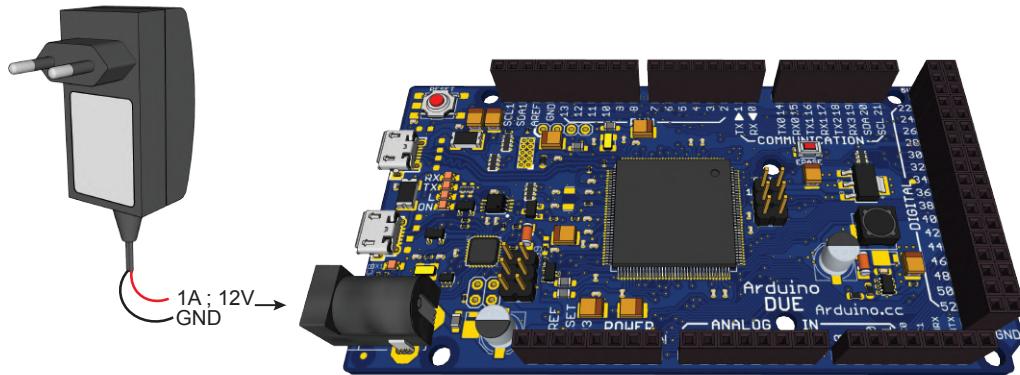
- BAR 1 (PIN 23)
- BAR 2 (PIN 25)
- BAR 3 (PIN 27)
- BAR 4 (PIN 29)
- BAR 5 (PIN 31)
- BAR 6 (PIN 33)
- BAR 7 (PIN 35)
- BAR 8 (PIN 37)

DIGITAL PINS FOR EXTERNAL CONTROL

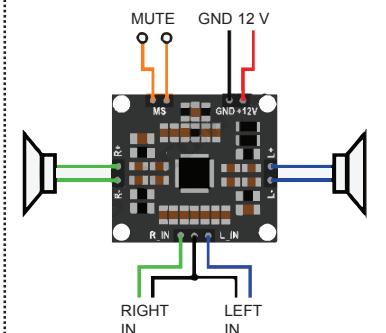
- Input pin (48) used to Abort experiment (Abort).
- Input pin (50) by which ESP8266 controls SOUND.
- Output pin (53) used to generate a reference signal (a square wave) that represents sound modulator.
- Input pin (52) by which ESP8266 controls SHOCK.

SOUND OUTPUT

Buid in KiCad EDA 5.1.2 (<http://www.kicad-pcb.org/>)



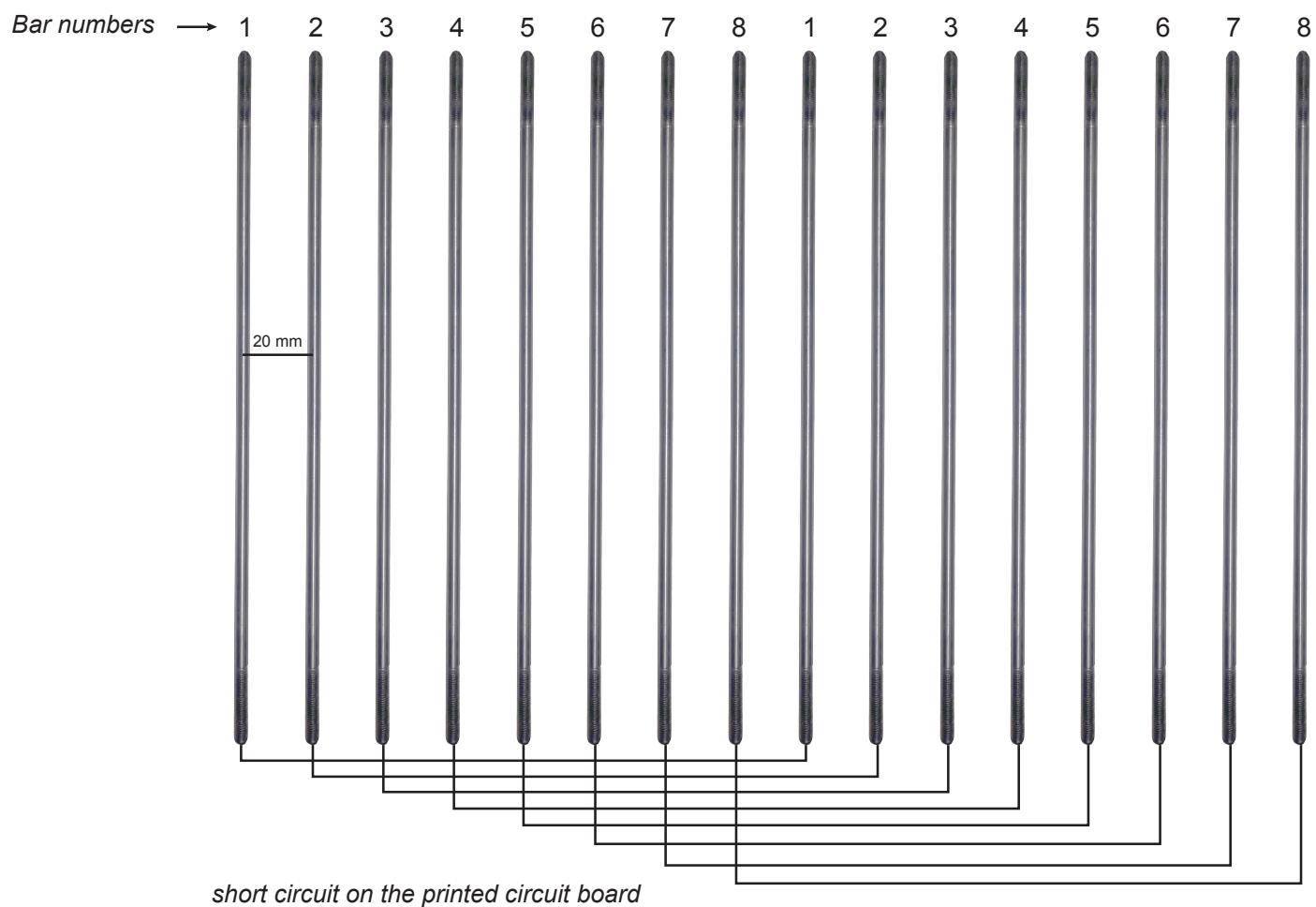
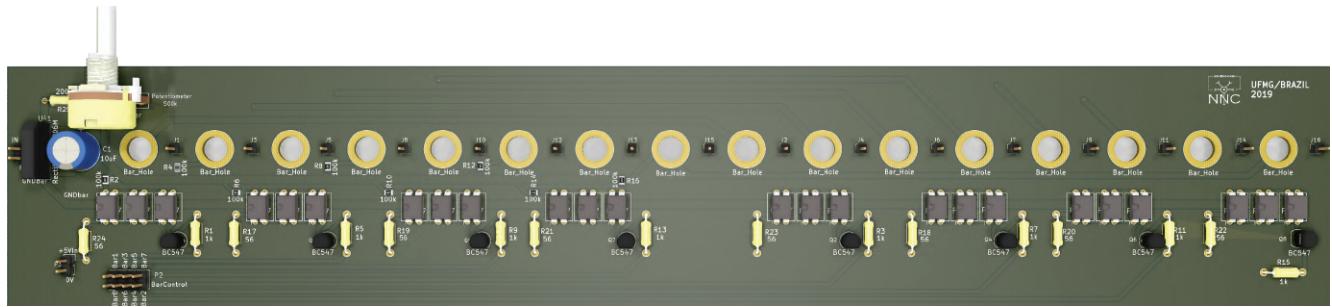
Suggestion:
PAM8610 10W STEREO AUDIO AMPLIFIER MODULE



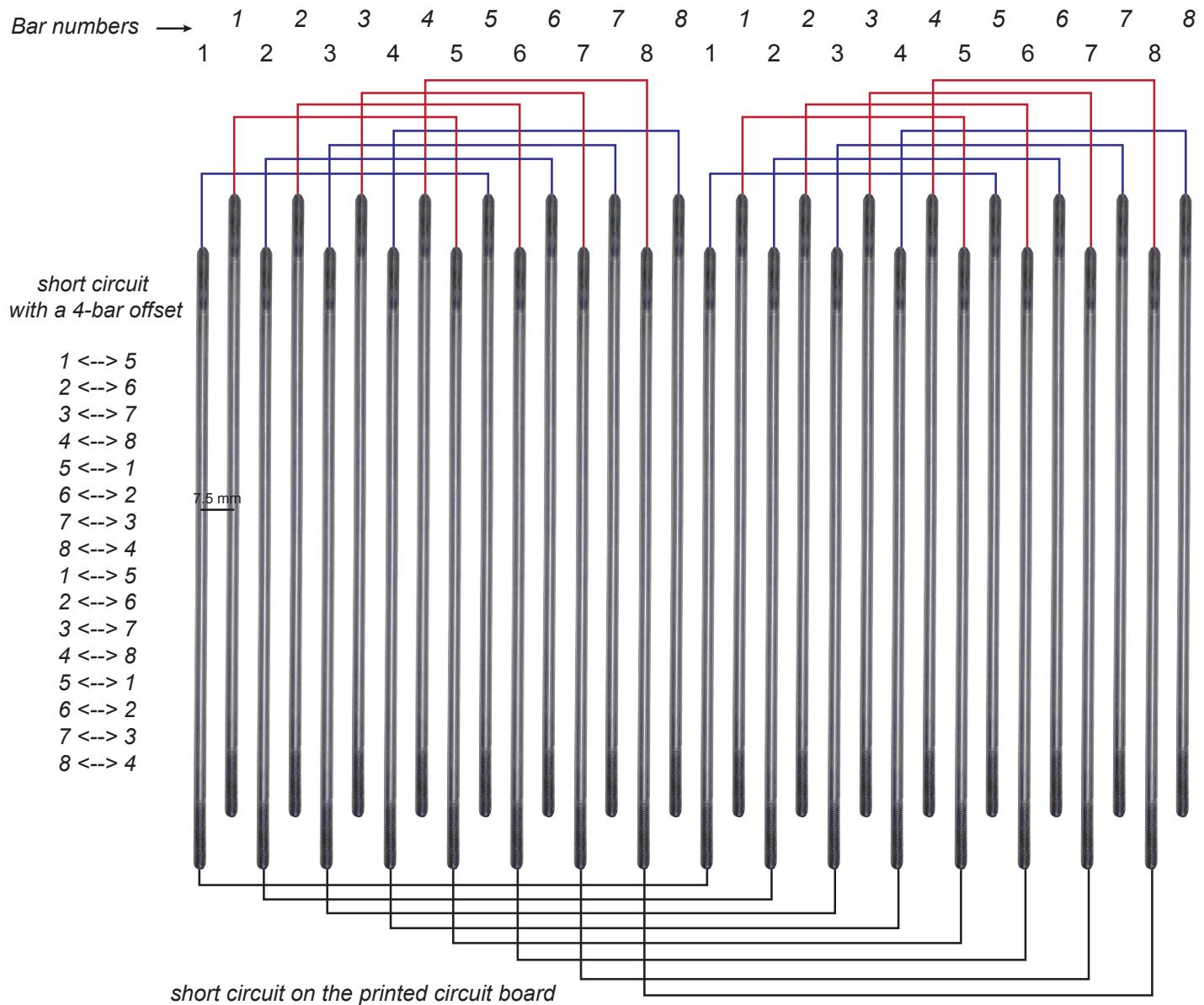
in this case a power source > 1A is required

<https://hobbycomponents.com/audio/664-pam8610-10w-stereo-audio-amplifier-module>

Original bar configuration for experiments with rats



Design for experiments with mice



For experiments with mice the number of bars can be increased up to 32 and spaced 7.5 mm from each other. We suggest an external short circuit wired with a 4-bar offset. So that there are no repetitions in an 8-bar sequence covering the full animal extent.

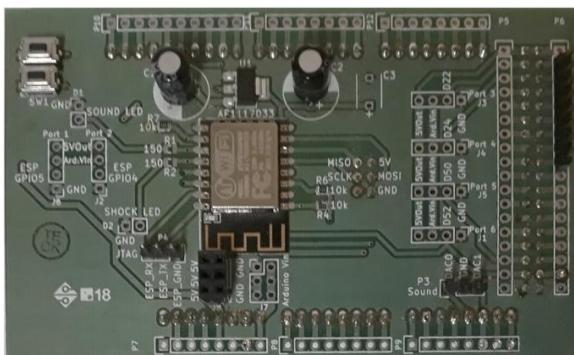
Power Supply

Component	Specification	Quantity
Isolated Transformer	0.03KVA; 127V _{AC} :220V _{AC}	1
Power Supply	1A; 12V	1

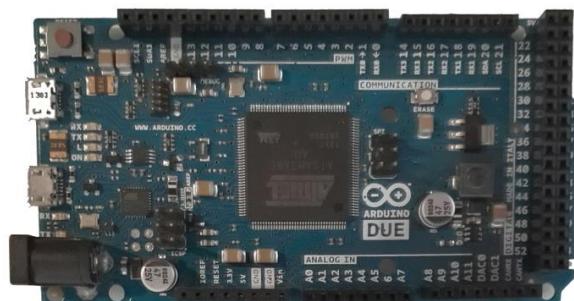
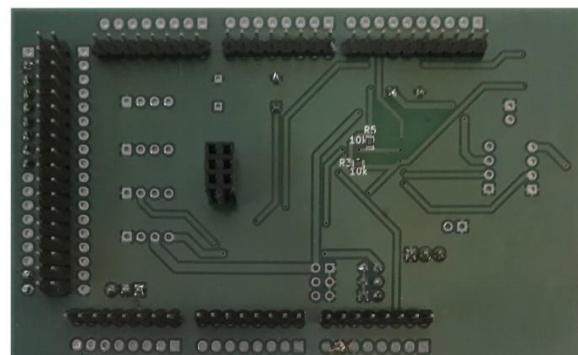
Two-layer printed circuit board with control circuit. It has ESP8266-12E footprint and an Arduino Due shield

Component	Quantity
Arduino DUE	1
Module WI-FI ESP8266-12E	1
FTDI Serial TTL-232 USB	1

*TOP



*BOTTOM



Component	Model	Specification	Quantity
LDO Voltage Regulators	AP1117D33	47uF 55V	1
Radial Electrolytic Capacitor		147uF, 550V	2
Resistor SMD		10kΩ 1%	4
Ceramic Capacitor		47uF, 50V	1
SMD Tactile Push button / Key Switch (2 x 6 x 2.5 mm)	KFC-A06		2
Male Pin Headers 2.54mm single (1 x 3 pins)			8
Male Pin Headers 2.54mm single (1 x 4 pins)			6
Male Pin Headers 2.54mm single (1 x 8 pins)			5
Male Pin Headers 2.54mm single (1 x 10 pins)			1
Female Pin Headers 2.54mm single (2 x 3 pins)			1
Dual Pin Headers 2.54mm single (2 x 18 pins)			1

Two-layer printed circuit board with power circuit. Attached to the chamber via 16 mounting holes, this board allows creating electric potential between the conductive bars.



Component	Model	Specification	Quantity
Resistor Through-hole		56Ω 5% 1/4W	8
Resistor Through-hole		1kΩ 5% 1/4W	8
Resistor Through-hole		200kΩ 5% 1/4W	1
Resistor SMD		100kΩ 1% 1/4W	8
Potentiometer -Type B Linear response curve		500kΩ	1
Radial Electrolytic Capacitor		10uF, 350V	1
Bridge Rectifier Diode	2KBP06M	2600V, 2A.	1
Optocouplers	PC817 4-pin	-	24
Transistors	BC547B	-	8
Pin Headers 2.54mm single (1 x 12 pins)			1
Dual Pin Headers 2.54mm single (2 x 4 pins)			1
Pin Headers 2.54mm single (1 x 2 pins)			2
Female Jumper wires			12

Stainless steel cylindrical bar and hex nuts



250 mm

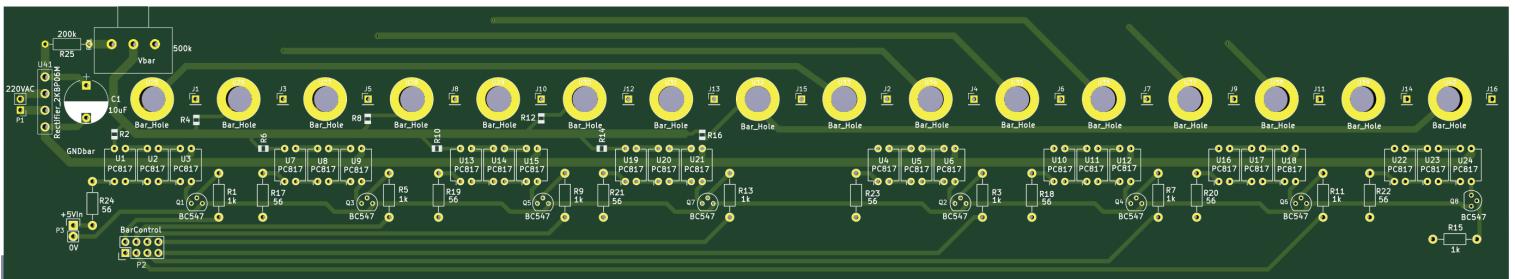


| 5 mm

Component		Quantity
Stainless steel cylindrical bars	250 x 5 mm	32 (or 64)
Stainless steel hex nuts	5 mm	64 (or 128)

Printed circuit boards with its components map

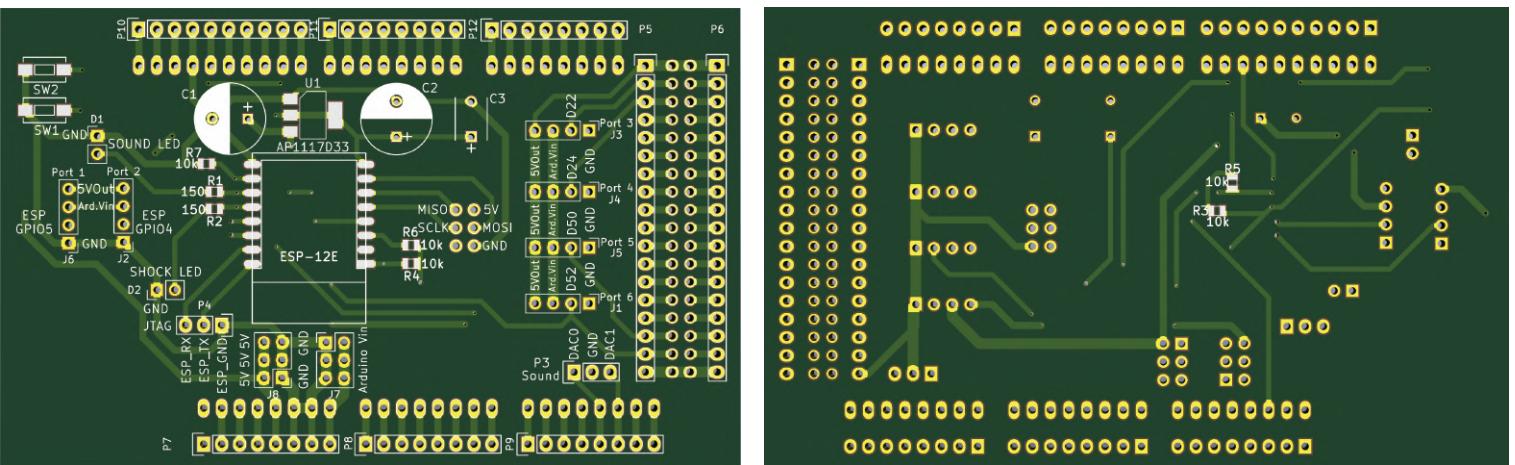
Bars circuit



Legend:

- . P1 - Isolated transformer input
- . P2 - Bar control input
- . P3 - Input from Arduino output 5V
- . U1 -> U24 - Optocouplers PC817
- . U41 - Bridge Rectifier Diode
- . Q1 -> Q8 - Transistors BC547B
- . R2,R4,R6,R8,R10,R12,R14,R16 - Resistor SMD 100kΩ
- . R1,R3,R5,R7,R9,R11,R13,R15 - Resistor SMD 1kΩ
- . R17 - R24 - Resistor SMD 56Ω
- . R25 - 200kΩ
- . C1 - Radial Electrolytic Capacitor 10uF, 350V
- . J1 -> J16 - Pins for current test
- . No stamp - upper left corner - Potentiometer, Type B Linear response curve, 500kΩ

Control circuit to be attached on Arduino shield



Legend:

- . P3 - Arduino Digital-Analog converter ports for sound output (Default DAC1)
- . P4 - Serial port to program ESP8266. GND, TX (Transmit) and RX(Receive)
- . P5 -> P12 - Pin Headers that will connect to the Arduino board. Need to be welded underneath.
- . Port1 - Port6 - Generic Arduino/ESP8266 outputs (5v out, GND, Arduino in, ESP GPIO04/05, Digital out)
- . J8 - Generic Arduino outputs (5v out, GND)
- . J7 - Generic Arduino outputs (GND, Arduino Vin)
- . D1 - LED signaling sound on
- . D2 - LED signaling shock on
- . SW1 -> SW2 - SMD Tactile Push button to put ESP8266 into programming mode (*Hold down the GPIO 0 button --> Press the Reset button --> Then let go of both buttons*).
*SW1 - GPIO 0
*SW2 - Reset
- . R1, R2 - Resistor SMD ~150Ω
- . R3 (bottom), R4 (top), R5 (bottom), R6 (top), R7 (top) - Resistor SMD 10kΩ
- . U1 - LDO Voltage Regulator 47 uF, 55V
- . C1, C2 - Radial Electrolytic Capacitor 147uF, 550V.
- . C3 - Ceramic Capacitor 47uF, 50V optional...but don't need
- . In the center of the circuit to the right side of the ESP8266 - Female Pin Headers that will connect to the Arduino board (MISO/SCLK/5V/MOSI/GND). Need to be welded underneath.

Wiring diagram

