

# Platypus AudioToy Technical Manual

8x8 Matrix Audio Mixer hardware  
for the  
Teensy Audio Library

An 8x8 sound card based on the CS42448 and CS CS5343  
Two input modules for balanced or unbalanced mic/line or  
inst/line operation  
An output module capable of driving balanced or unbalanced  
loads at +8dbM  
An I2C to GPIO expander board that also drives WS2812B  
LEDs.

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## Description

The Platypus AudioToy is a modular 8x8 sound card intended to be fully software compatible and generally hardware compatible with Paul Stoffregen's revised CS42448 8x8 audio board (see <https://hackaday.io/project/2984/logs>) and software compatible with the CS42448 and TDM objects in the Audio Library. A single register write is required to enable balanced inputs on the CS42448 (which has the potential to improve SNR by 6dB).

The main codec board employs a CS42448 6 x8 codec with a satellite CS5343 two input ADC. This chip has marginally better specifications than the PCM1808 used in Paul's design. It features fully balanced inputs and outputs wired to headers that also provide power for preamps.

While additional +/- supplies specifically for audio circuits are supported, all the boards in the set operate off a single 5V supply, either via USB or a power adapter. All control functions (other than a single pin to drive WS2812B level indicator LEDs) are I2C controlled, to preserve GPIO pins for other purposes.

A small utility board provides I2C to GPIO conversion to preserve Teensy GPIO pins, and a level shifter to drive a WS2812B LED string for level indicators.

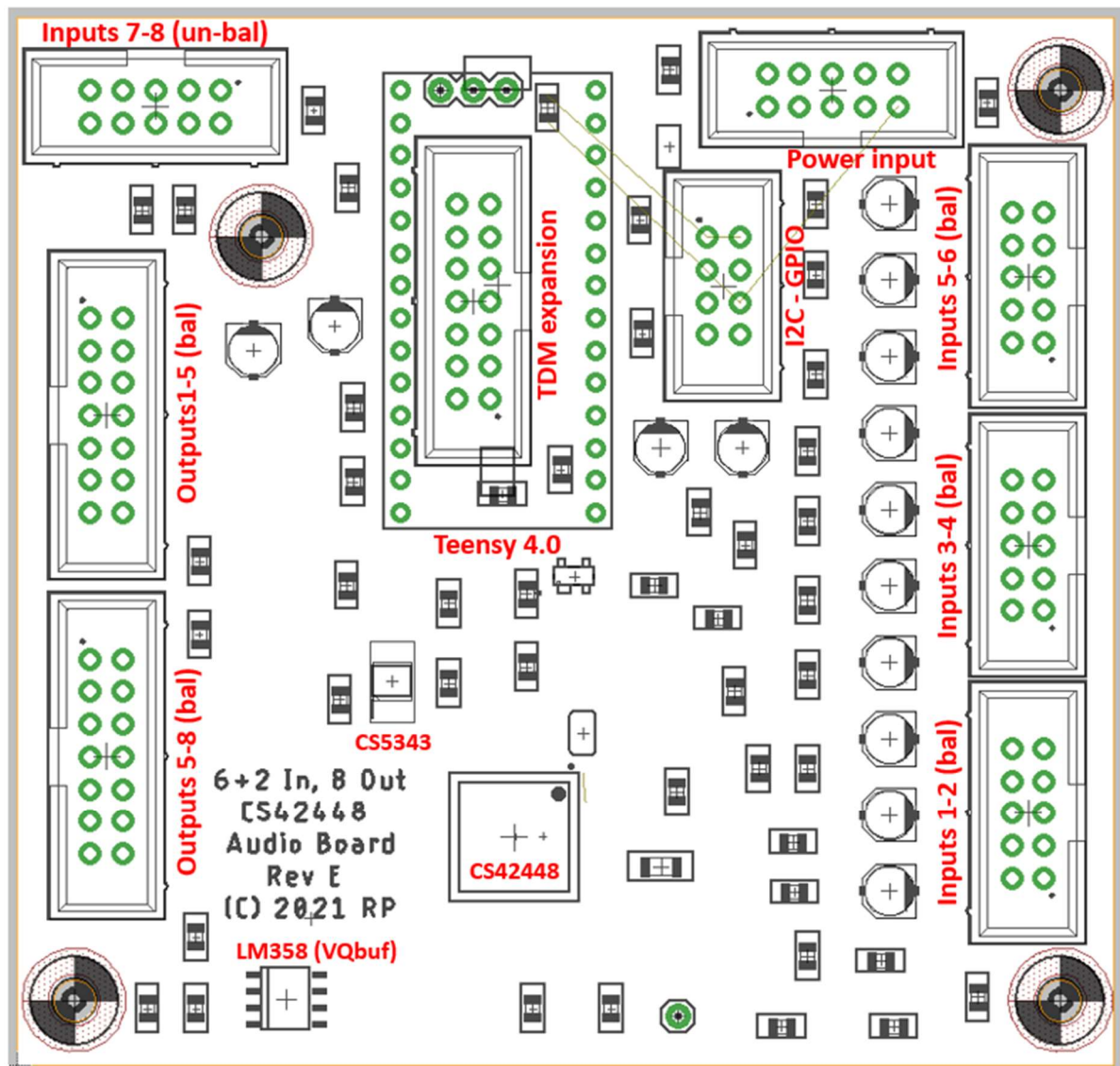
Two fully-interchangeable input boards are offered, both accepting either balanced or unbalanced inputs and gain-controlled via I2C:

- A two channel mic/line preamp employing TS472 preamp chips that have their gain controlled by a MCP47B22 two channel I2C DAC. Input is via an XLR-TRS combo jack that auto-switches to 'straight through' operation for line-level inputs. TRS insertion is available as a GPIO signal.
- A two channel inst/line preamp employing MCP604 opamps in a gain-controlled balanced instrument amp configuration. The control elements are MCP4651 digital pots. A GPIO pin (to the IS2 to GPIO board) controls a 20dB pad, extending the gain range of the module.

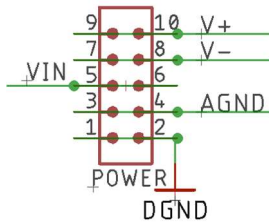
An output board, also employing MCP604 opamps provides buffered differential outputs capable of driving 600 ohm lines at +8dBm

The modules were designed as part of a larger project to develop a compact, remote controlled, 8x8 monitor matrix mixer for live performance. The mixer is WiFi enabled with a comprehensive browser interface plus a standalone touch screen controller based on an ESP32.

## Main Codec board



## Power header



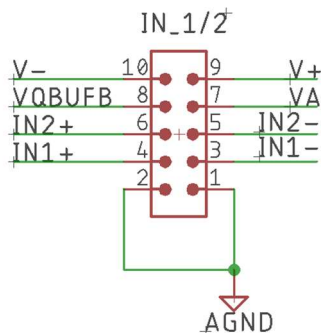
VIN is connected to the same named pin on the Teensy 4 socket. It is a general purpose 5V supply.

V+ and V- are routed to the input and output connectors, if additional power rails are required beyond a decoupled 5V supply.

Analog and Digital grounds are separated wherever possible to reduce audio noise. Where possible, Vin should be returned via DGND, V+ and V- via AGND.

## Input headers

Two channels of balanced input audio are carried on each header (inputs 7-8 are unbalanced, on the INx+ pin).



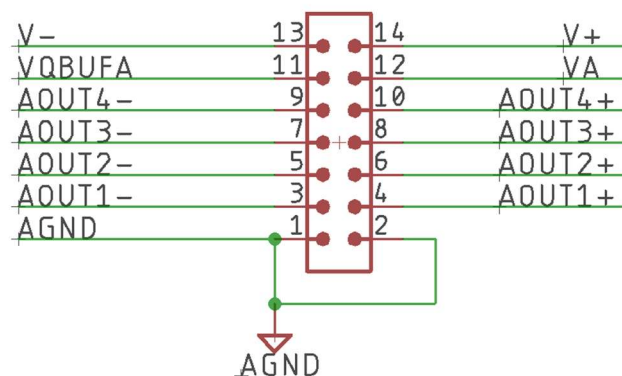
V+ and V- are audio voltages provided by the power input header.

VA is a decoupled 5V supply derived from VIN.

VQBUFB is a buffered CS42448 VQ voltage for inputs 1-6. Inputs 7-8 have an unbuffered VQ voltage from the CS5343.

## Output headers

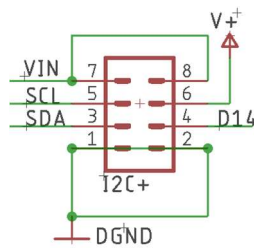
Four channels of output audio are carried on each header.



Voltages are as for the Input headers.

## Auxiliary headers

### I2C



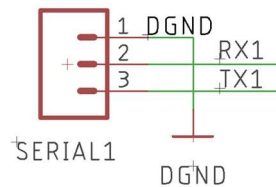
3.3V (V+) and 5V (VIN) are provided.

SDA and SCL have on-board 2.2k pullups to the 3.3V rail.

Pin 4 is connected to GPIO D14 (the standard GPIO for the WS2812B library).

### Serial

A serial connection, directly connected to Teensy pins D0 and D1 is provided.



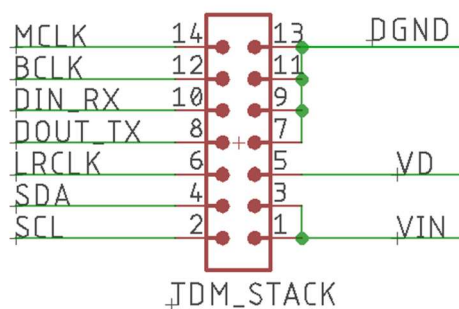
### TDM stacking (experimental)

An additional header to accommodate Paul Stoffregen's planned TDM stacking capability is provided. Positional alignment is as close as is possible by visual alignment with the image in Paul's Hackaday post (<https://hackaday.io/project/2984/logs>).

VD is 3.3V. VIN is 5V.

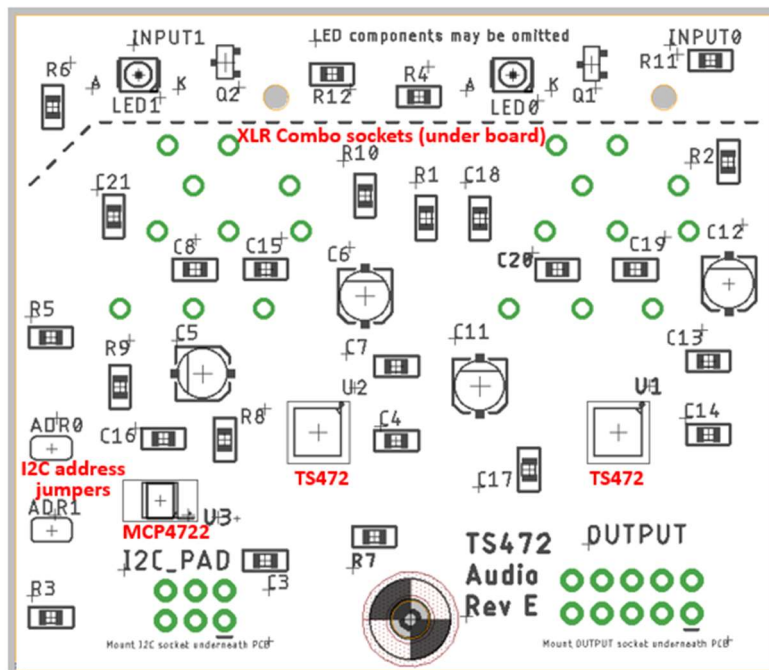
*It has not been tested and the pins may not be correct.*

*It is understood that additional hardware will be required for boards to be successfully stacked.*



# Two Channel TS472 Mic/Line Input Board

## Layout



Input and output headers are as defined for the main board.

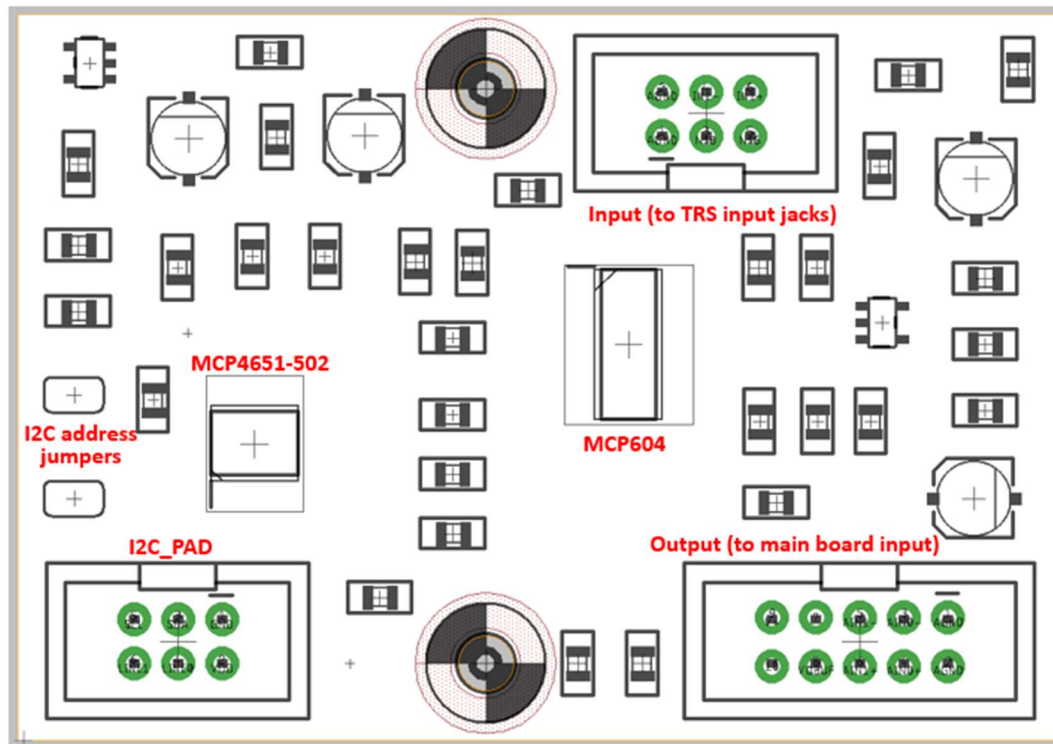
Only 5V (VA) is used on this board.

A separate 5V supply is provided for the MCP4722 via the I2C\_PAD connector.

The XLR Combo sockets, as well as the I2C\_PAD and Output headers are mounted *under* the PCB.

Two address jumpers are provided to permit up to four boards to be used on a single I2C bus.

## Two Channel MCP604 Line/Inst Input Board



Input

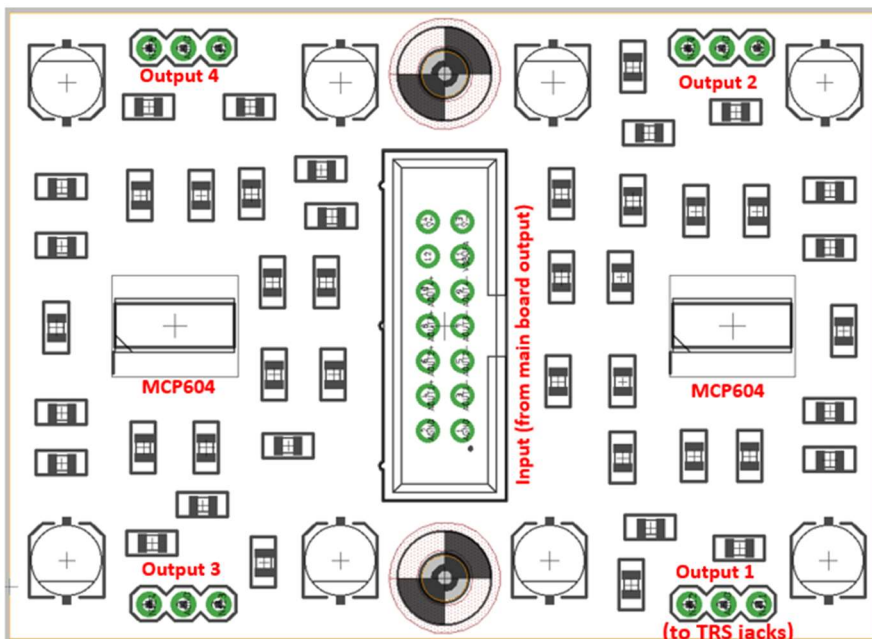
and output headers are as defined for the main board.

Only 5V (VA) is used on this board.

A separate 5V supply is provided for the MCP4561 via the I2C\_PAD connector.

Two address jumpers are provided to permit up to four boards to be used on a single I2C bus.

## Four Channel Output Board



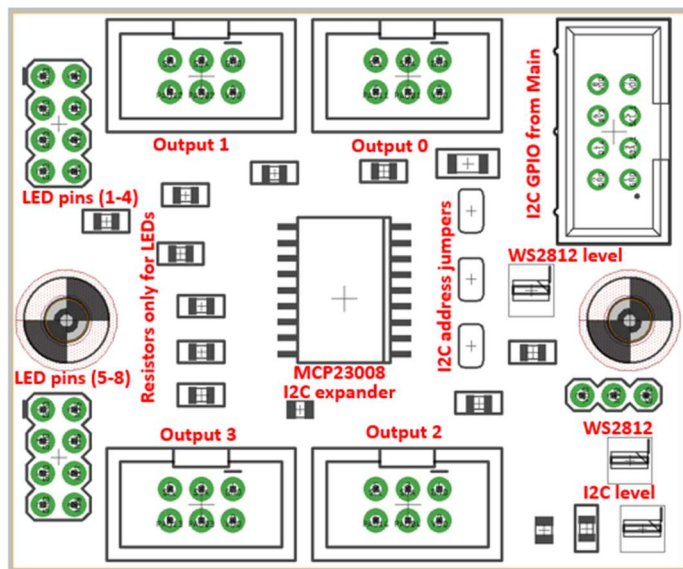
Input header is as defined for the main board.

Output headers have GND on the middle pin to allow flexibility in output polarity.

Positive output is Pin3 (right hand in orientation above: input connector Pin1 at the bottom)

Only 5V (VA) is used on this board.

## I2C extender / WS2812 Driver Board



LED connectors: GND is to the edge of the board.

WS2812 connector: GND is to the edge of the board.



# Specifications

## Main board

Footprint	86 x 82mm
Power:	5V DC
Inputs:	4 x 10 pin shrouded headers (each 2 channels of balanced audio + 3 power pins, and buffered VQ reference voltage) Isolating input capacitors 6 balanced, 2 unbalanced inputs
Outputs:	2 x 14 pin shrouded headers (each 4 channels of balanced audio, 3 power pins, and buffered VQ reference voltage) 8 balanced outputs

## Inputs

### Two channel mic/line module

Footprint:	65 x 56mm
Power:	5V DC
Control:	6 pin header I2C and GPIO indicating TRS insertion
Audio/power:	10 pin header.
<b>XLR input:</b>	Electronically balanced or unbalanced XLR (no phantom power)
Gain:	0 to +62dB
Input levels:	110mV RMS maximum
Input impedance:	200 ohms
Harmonic distortion:	0.05%
Noise (EIN):	-68dB (balanced input @ 40dB gain, 150 ohm source impedance)
CS5343	Electronically balanced or unbalanced TRS
Gain:	0 to +23dB
Input levels:	2V RMS maximum
Input impedance:	35k ohms
Harmonic distortion:	0.005%
Noise (EIN):	-82dB (balanced input @0dB gain, 1k ohm source impedance)

### Two channel line/Instrument module

Footprint:	60 x 42mm
Power:	5V DC
Control:	6 pin header I2C and GPIO indicating TRS insertion

Audio/power:	10 pin header.
Connection:	Electronically balanced or unbalanced TRS
Gain:	6 to +46dB (-20dB pad)
Input levels:	2V RMS maximum 12V RMS with pad
Input impedance:	500k ohms (2k ohms with line pad)
Harmonic distortion:	0.005%
Noise (EIN):	-82dB (balanced input @0dB gain, 1k ohm source impedance))

## Outputs

### Four channel output module

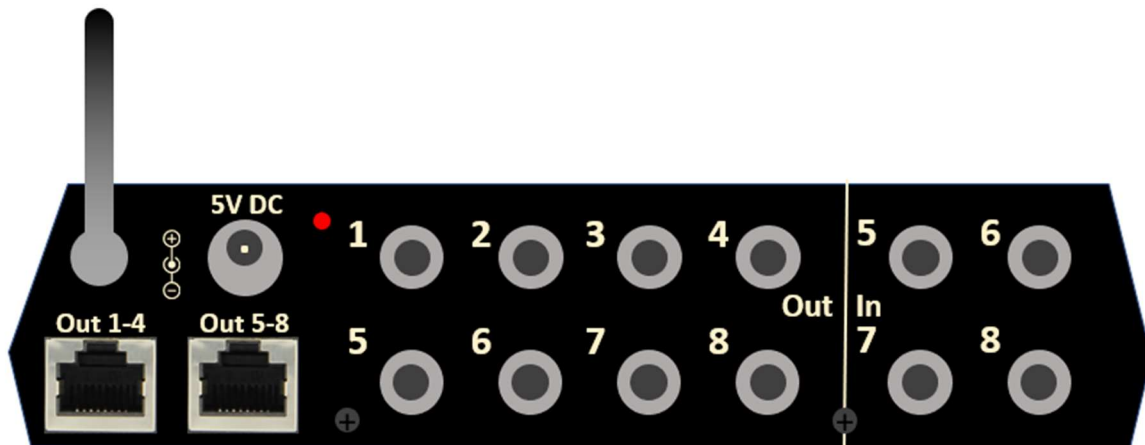
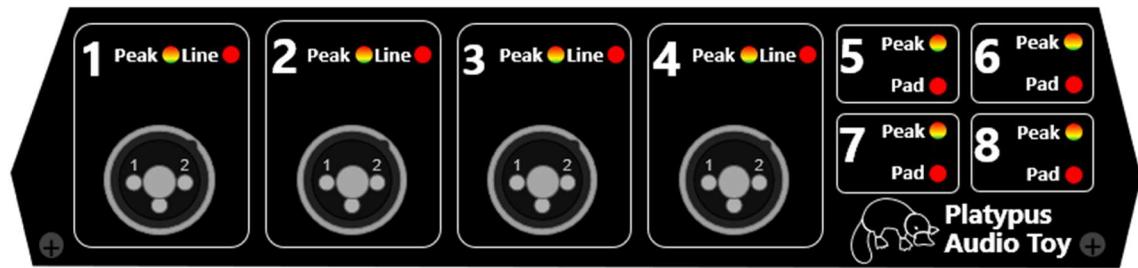
Footprint:	64 x 46 mm
Power:	5V DC
Audio/power:	14 pin header.
Connection:	Electronically balanced or unbalanced TRS
Output levels:	2V RMS (+8dbM) maximum into 600 ohms
Output impedance:	200 ohms
Noise (EIN):	-82dB (balanced input @0dB gain, 1k ohm source impedance))

## Electrical

Mainboard + 4 input and 2 output boards: 5VDC @ 0.3A

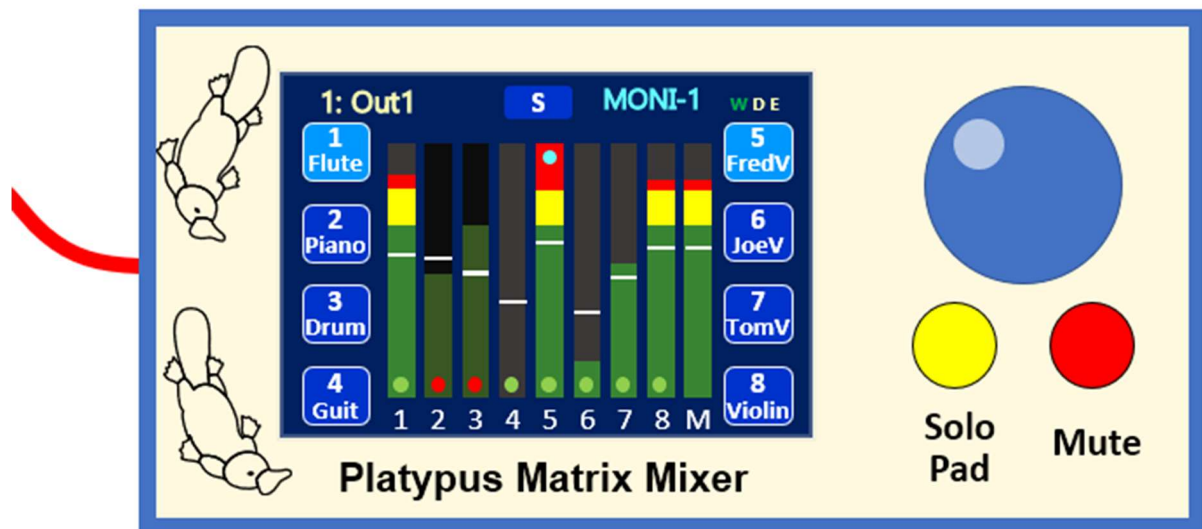
# AudioToy 8x8 Matrix Mixer Project

The main AudioToy unit



Inside the box

## WiFi Remote Control



## Browser Interface

