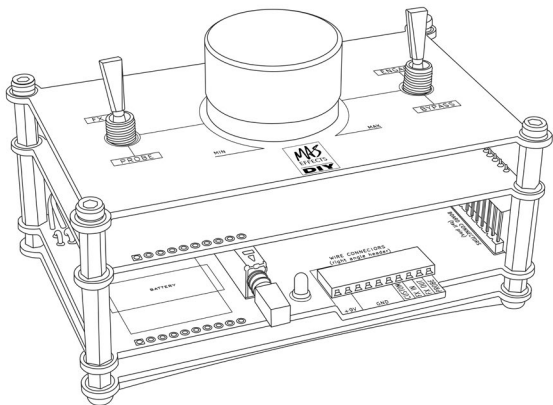


DIY PEDAL TOWER



Assembly & Usage

masfx.info/tower

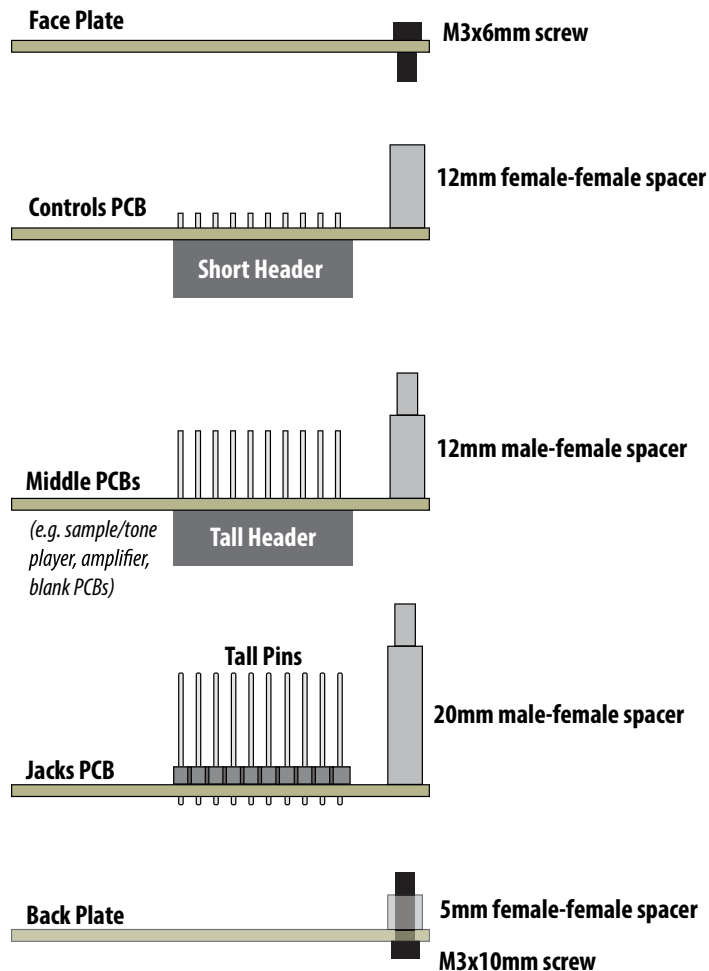


ASSEMBLY: Quick Overview

1. Solder the necessary components to each circuit board.
2. Assemble from the bottom-up. You could also do it top-down.
3. Refer to the next page to determine which spacers and hardware to use for connecting each layer.
4. Gently and carefully seat the pins into the header and press the layers together before securing spacer hardware.

Tip: We included one of the most useful pedal building tools in your kit: blue putty.

Use it to hold troublesome parts in place while assembling or soldering. Just avoid direct soldering heat or it makes a mess.



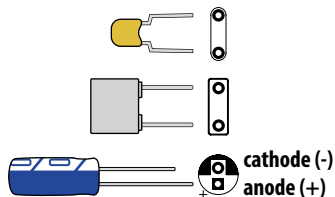
PARTS IDENTIFICATION

To keep this kit reasonably priced, we're not individually wrapping and labeling each and every part.

Instead we've grouped them into bundles where they'll be easily distinguished from one another as long as you recognize each general type of part. You will NOT have to decipher resistor color bands or capacitor codes.

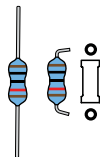
CAPACITORS

Begin with "C", e.g. "C301"



RESISTORS

Begin with "R", e.g. "R304"



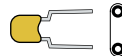
DIODES

Begin with "D", e.g. "D402"



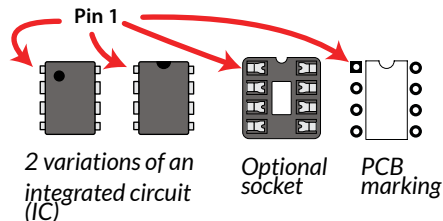
POLY FUSE

Begins with "F", e.g. "F401"

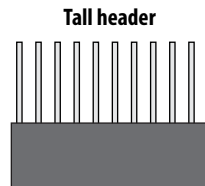
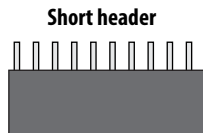


DIP-8 PACKAGE

Begin with "U", e.g. "U301." Either a dot or a half-circle shape will be present to indicate orientation



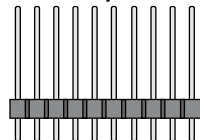
CONNECTORS



Right angle header



Tall pins



FOREWORD

NEED MORE HELP?

In the interest of brevity, this booklet omits many details. If you aren't sure what to do on any step, post to the forum and you can usually get help within minutes:

masfx.info/forum

This will also help future builders, as I'll continually update this booklet in response to your questions so that it's as useful and helpful as it needs to be.

THANK YOU

I hope this testing and prototyping tower proves to be as useful to you as it has been for me!

Please post back to our forum, or r/diypedals, or diystompboxes.com, or your favorite online pedal building group! Share it with other DIY pedal builders, provide feedback, and show off any customizations you make to it.

Don't hesitate to reach out, directly or on the forum, with any questions, problems, or feedback. Thanks!

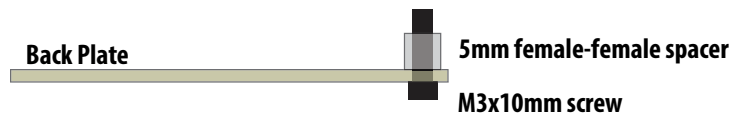
Mark A. Stratman
mark@mas-effects.com

BACK PLATE ASSEMBLY

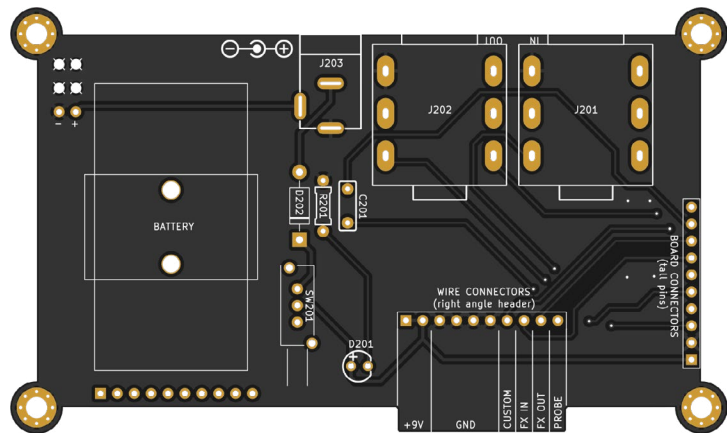


Attach 4 adhesive-backed rubber feet.

Run a M3x10mm screw through each corner and secure it in place with a 5mm female-female spacer.



JACK PCB ASSEMBLY



ELECTRONIC COMPONENTS

Install and solder **R201**, **C201**, **D201**, and **D202**.

Pay attention to polarity with **D201** and **D202**. They must be installed in the correct orientation.

D201: The longer leg of the LED should go into the side labeled “+” on the PCB

D202: The side with the stripe should align with the stripe printed on the PCB

POWER SWITCH

Push the plastic cap onto the power switch

Install and solder the switch onto the SW201 footprint. The switch’s cap will overhang the edge of the board slightly.

Use the blue putty if necessary to hold it in place while you solder.

JACKS

Install and solder the 2 phone jacks and DC power jack.

The phone jacks come with a flat inner washer, a curved outer washer, and a metal threaded insert. These are for panel-mounting, so installing them is optional.

BATTERY CLIP

Attach the metal battery clip to the PCB using two M2x5mm screws, and two M2 nuts.

JACK PCB CONTINUED

BATTERY SNAP CONNECTOR

Trim the battery snap connector's wires to approximately 6cm, or use your discretion to decide what length you prefer.

Weave each wire through the pair of strain relief holes next to the "+" and "-" pads. Temporarily pull the battery snap connector completely against the PCB to give yourself plenty of slack.

Strip the ends of the wire and solder the black wire to the "-" pad, and solder the red wire to the "+" pad. Back the wires out to remove the slack.

TIP: Twist and tin the wire ends if they are fraying and giving you trouble.

9V BATTERY (not included)

Install the battery into the clip. If you find it difficult, try pulling one side of the clip to widen it.

After the battery is installed, attach the snap connector.

Apply insulating tape (or another insulating material) to

the top of the battery to reduce the chance of shorting solder points on the board above it. This risk can also be mitigated by closely trimming any leads on the board above it.

TIP: Even if you don't plan to use the battery, it's useful for adding weight to the bottom of your stack, and stabilizing the platform.

CONNECTORS

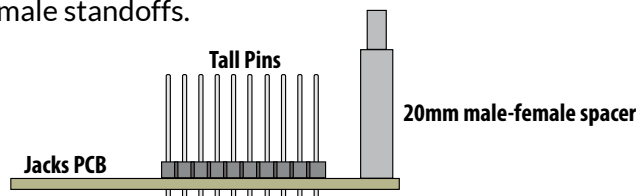
Install the right angle header where it says "WIRE CONNECTORS" and solder from the bottom of the PCB.

Install the tall pin headers into the "BOARD CONNECTORS" spot. The short end of the pins goes into the top of the board (the installation spot is indicated with a rectangle). Solder from the bottom.

TIP: Tack down one pin first, make sure it's straight, then solder the rest.

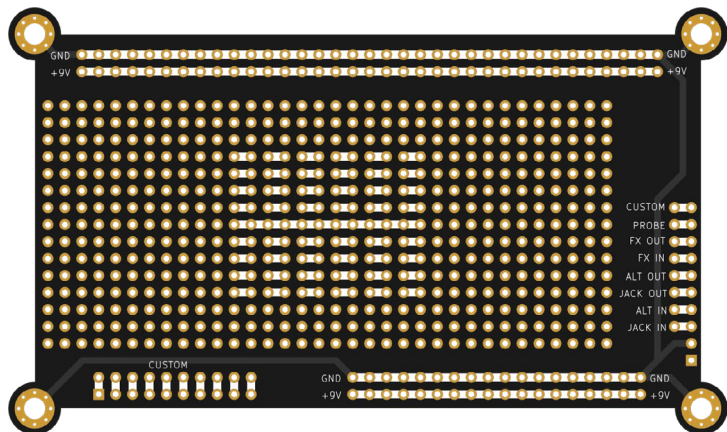
STACKING

Align the corner mounting holes with the standoffs and screws on the back plate. Secure with 20mm male-female standoffs.



ASSEMBLY (optional add-on)

BLANK CUSTOM LAYERS



This PCB has a variety of individual pads as well as pre-connected pads to give you flexibility and options in designing your own circuits. White lines represent the connections between the pads.

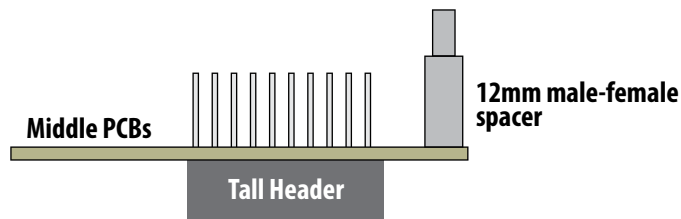
9V and GND rails are automatically powered and are available on the top and bottom of the PCB.

For more details see “HACKING & EXTENDING” on page 26.

CONNECTORS

FOR MIDDLE LAYERS

Follow these guidelines for all middle layers, such as the blank custom layer, amplifier/speaker, and tone and sample player:



Install the tall header into the “BOARD CONNECTORS” spot on the bottom of the board, indicated with a rectangle.

Solder the pins onto the pads on the top of the PCB.

TIP: Tack down one pin first, make sure it's straight, then solder the rest.

STACKING

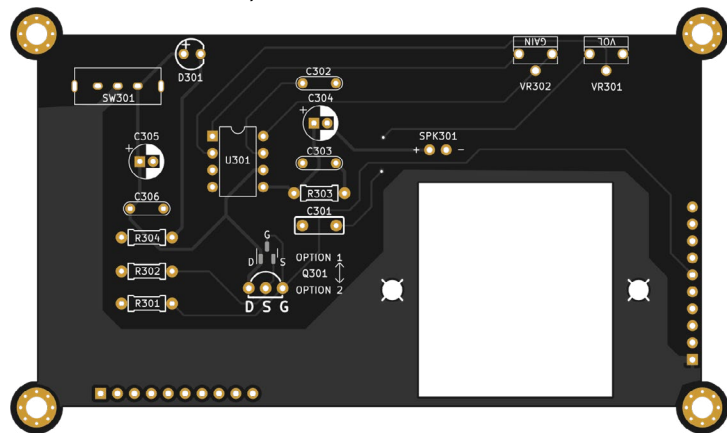
Align the corner mounting holes with the standoffs on the lower layer. Gently and carefully seat and press the header over the pins on the lower layer.

Secure with 12mm male-female standoffs.

ASSEMBLY (optional add-on)

AMPLIFIER & SPEAKER

See “CONNECTORS FOR MIDDLE LAYERS” on page 13 for how to connect and stack this layer.



ELECTRONIC COMPONENTS

Install and solder each of the resistors (R30x), capacitors (C30x), and diodes (D30x).

Take care not to mix up the different values of each type of component.

Pay attention to polarity and orientation for D301, C304, and C305. Refer back to pages 4-5.

JFET Q301

This is likely a surface mount device (SMD) and pre-soldered, but if not, line up your transistor's curved and straight sides with the printing on the PCB and solder into place.

SPEAKER

Install the speaker into the square hole, lining up its mounting holes with those on the PCB. Make sure the speaker's wires are nearer the “SK301” pads.

Secure with M2x8mm screws and nuts.

Trim the speaker wire, strip, and solder into place. Black connects to the “-” pad, red connects to the “+” pad.

POWER SWITCH

Use blue putty if needed to hold the power switch, SW301, in place while you solder it.

TRIMMERS

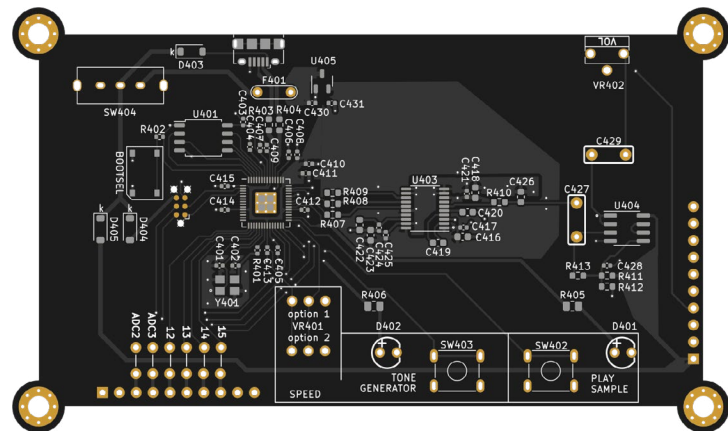
Install and solder VR301 (marked 103 on its dial) for volume, and VR302 (102) for gain. These are set-and-forget values, adjusted by ear to your preference.

For now, set gain to ~20% and leave volume at ~50%. 15

ASSEMBLY (optional add-on)

SAMPLE & TONE PLAYER

See “CONNECTORS FOR MIDDLE LAYERS” on page 13 for how to connect and stack this layer.



ELECTRONIC COMPONENTS

Install and solder the fuse (F401) and each of the LEDs (D401, D402). Pay attention to the polarity of the LEDs.

Install and solder C427 and C429. Although we needed to use primarily SMD capacitors for this project, these two were chosen as through-hole film type since they’re directly in the audio path. While suitable SMDs could have been found, this is a simpler and less expensive way to help avoid noise.

BUTTONS & POWER SWITCH

As usual, use putty if necessary to hold the buttons, SW402 and SW403, and the power switch, SW404, in place while soldering.

VOLUME TRIMMER

Install and solder VR402.

This will be tuned by ear to help achieve unity with your guitar’s input signal. Set to about ~20%.

SPEED POTENTIOMETER

There are two possible installation options for the speed potentiometer, VR401.

“Option 1” is recommended and sits further back. The pot shaft will be slightly sticking out. This is usually okay because you won’t frequently change the tone speeds.

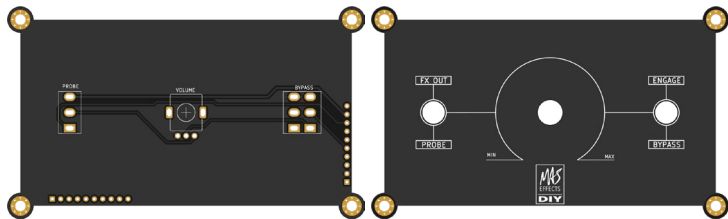
“Option 2” leaves the pot shaft sticking further out from the tower, giving you easier access to it.

ADC and GPIO PADS

For now, disregard the pads at the lower left. For more information see “HACKING & EXTENDING” on page 26.

ASSEMBLY

CONTROLS & FACE PLATE



Take the nuts and washers off the volume pot and PROBE and BYPASS switches. Save for a rainy day or recycle them.

Place the PROBE switch and use blue putty to get it as straight as possible. Solder one lug into place.

Do the same for the BYPASS switch and volume potentiometer.

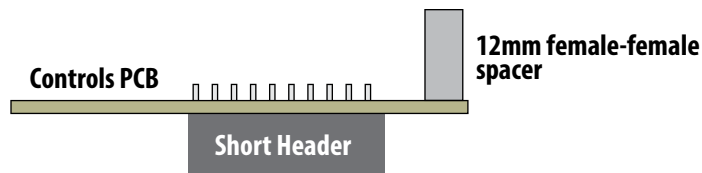
Temporarily dry-fit the face plate's 3 holes over the controls and ensure everything is aligned and the face plate fits neatly. If not, reheat the solder joint on whichever control is misaligned and fix it.

Solder the rest of the joints.

CONNECTORS

Place the short header into the "BOARD CONNECTORS" spot

on the bottom of the control board and solder the pins on top.



Align the corner mounting holes with the standoffs on the lower layer. Gently and carefully seat and press the header over the pins on the lower layer.

Secure with 12mm female-female standoffs.

FACE PLATE

Attach the face plate with M3x6mm screws.



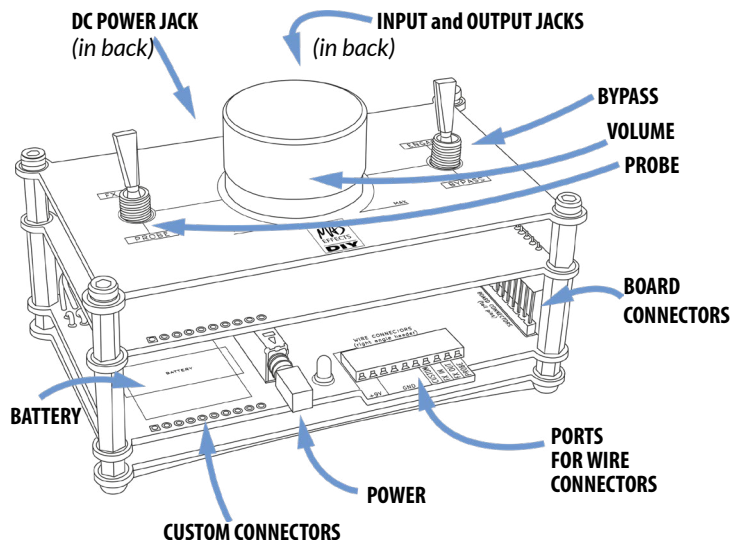
VOLUME KNOB

Turn the volume all the way up, align the knob's pointer with the "MAX" on the face plate, and press into place.

IMPORTANT: Lift the knob slightly so it turns smoothly and doesn't scrape the face plate.

TIP: If the knob is too loose, remove it and gently pry the prongs of the potentiometer shaft apart, just a hair. Pry them the tiniest amount you can and check again. Over-extending will cause them to break.

WALKTHROUGH



INPUT & OUTPUT JACKS

Plug in a guitar, bass, or other input signal into the INPUT jack, and connect the OUTPUT jack to an amplifier. Details in “USAGE: INPUT / OUTPUT” on page 22.

PORTS

Plug male breadboard pin connectors into these to interface the tower with your projects. The other end of the wire can be another male pin, a female socket, an alligator clip, or more.

POWER

This is the master power switch for the entire tower. Other layers may have their own sub-power switches.

DC POWER JACK

IMPORTANT: Requires **9V center negative**. This is standard for guitar pedals, but non-standard for everything else.

BATTERY

If the DC power jack is removed, power will be drawn from here. This also provides weight to help the tower maintain a low center of balance.

VOLUME

This controls the master volume for the entire tower. Other layers may have their own sub-volume pots or trimmers.

BYPASS

When bypassed, the input signal will route directly to output, like a “true bypass” pedal.

PROBE

See “USING THE AUDIO PROBE” on page 25.

BOARD & CUSTOM CONNECTORS

See “HACKING & EXTENDING” on page 26.



Dry input and wet output signals will go to jack if a cable is plugged in.

When unplugged, the signal will be routed to the “ALT IN” or “ALT OUT” pins on the main board connectors. These are used by the tone/sample player and amplifier+speaker add-ons. They can also be used by your custom layers.

Your circuit receives its dry audio signal from the “FX IN” port.

The output of your circuit should go to the “FX OUT” port.

POWERING YOUR CIRCUIT

EXTERNAL POWER

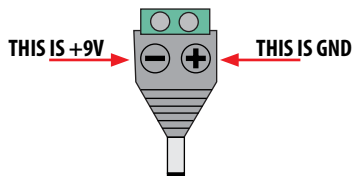
Sometimes you may want to use power from an alternate source outside of the tower, e.g. to probe a pedal on your pedal board that's plugged into a power supply. When doing this, simply make a connection from a GND port on the tower to a GND point on your pedal.

TOWER POWER

Most of the time, however, your circuit will draw power from the tower. In this case you'll connect both GND and +9V ports.

Depending on your circumstances, use male pins, female pin sockets, alligator clips, or the 2.1mm barrel jack with male pin wires screwed onto it.

IMPORTANT: The 2.1mm barrel jack's polarity symbols are reversed for guitar pedals.



USING THE AUDIO PROBE

If you hook your breadboard or pedal guts or other circuit up to the FX IN and FX OUT ports but can't hear any sound coming through, never fear, the audio probe is here!

First verify everything is hooked up correctly by switching to BYPASS and making sure you can hear your dry input signal.

Now plug any type of connector into the PROBE port. Set the top switches: ENGAGE and PROBE.

Touch the probe to parts of your circuit to hear your signal and how it may be modified or dampened. Work from the output back toward the input, or from the input to the output until you find your problem. Or start at the most likely problem areas, if you have suspicions.

If you're not sure how to interpret the information, make a log of your observations and post them to a DIY pedal group (e.g. [reddit.com/r/diypedals](https://www.reddit.com/r/diypedals) or [diystompboxes.com](https://www.diystompboxes.com)) along with your schematic.

FYI: The probe has a built-in DC blocking capacitor, so it is safe to probe parts of your signal with a DC bias.

HACKING & EXTENDING

This tower has been specifically designed to be highly customizable. You can use the blank layer PCBs MAS Effects sells, or design your own PCB. Visit masfx.info/tower to get the PCB design files.

BOARD CONNECTORS

From bottom to top:

- **+9V** (square pad)
- **GND**
- **INPUT JACK**: dry input signal when a cable is inserted
- **ALT IN**: dry input signal when a cable IS NOT inserted
- **OUTPUT JACK**: wet output destination when cable is inserted
- **ALT OUT**: wet output destination when cable IS NOT inserted
- **FX IN**: insertion point for dry input signal into the user's circuit
- **FX OUT**: capture point for the wet output signal from the user's circuit
- **PROBE**: alternate capture point for the wet output signal
- **CUSTOM**: unused by the MAS Effects tower PCBs. Use this for board-to-board communication

In addition to the CUSTOM pin in the main board connectors header, there are 10 custom unused pins at the front of every layer PCB. These are unused by the MAS Effects tower PCBs and can be used for whatever your heart desires.

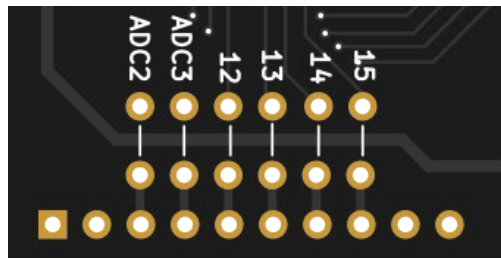
You can connect them with headers and pins, as we did with the main board connectors, or a simpler and cheaper option is to use long strands of wire threaded through all layers of your stack.

SAMPLE AND TONE PLAYER

Similarly, the sample and tone player has been designed with extensibility in mind.

For example, the ability to record your own sample is something that was left out of the main feature set in order to keep costs down, but we've ensured it could easily be added after the fact.

Specifically, ADC2, ADC3, and GPIO 12-15 have been routed down to the custom header pins.



For any pins you'd like to use, wire a jumper between the top two pads shown here. This connects it to the custom header.

We've released our firmware under the GNU General Public License. See the copy in the source directory for details, but in short you may use, modify, and distribute the firmware freely as long as when you distribute it you include the source for your modifications (i.e. the software is and must remain open).

You can flash the firmware with USB, or we've exposed SWD and UART via a Tag-Connect header. Pins are: 1. UART RX, 2. SWD, 3. UART TX, 4. SWCLK, 5. GND, 6. +5V

Firmware, schematics, and more available at masfx.info/tower



mas-effects.com