protoSTAX

STACKABLE MODULAR ENCLOSURES
THE ENCLOSURE THAT EVOLVES WITH YOUR PROTOTYPE

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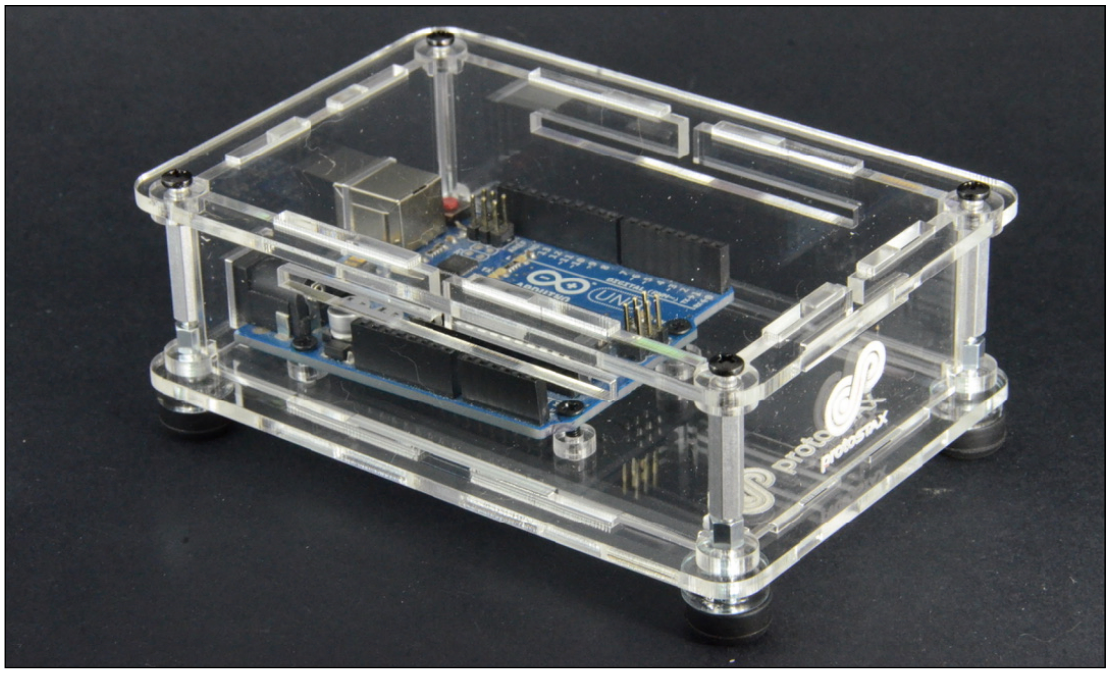

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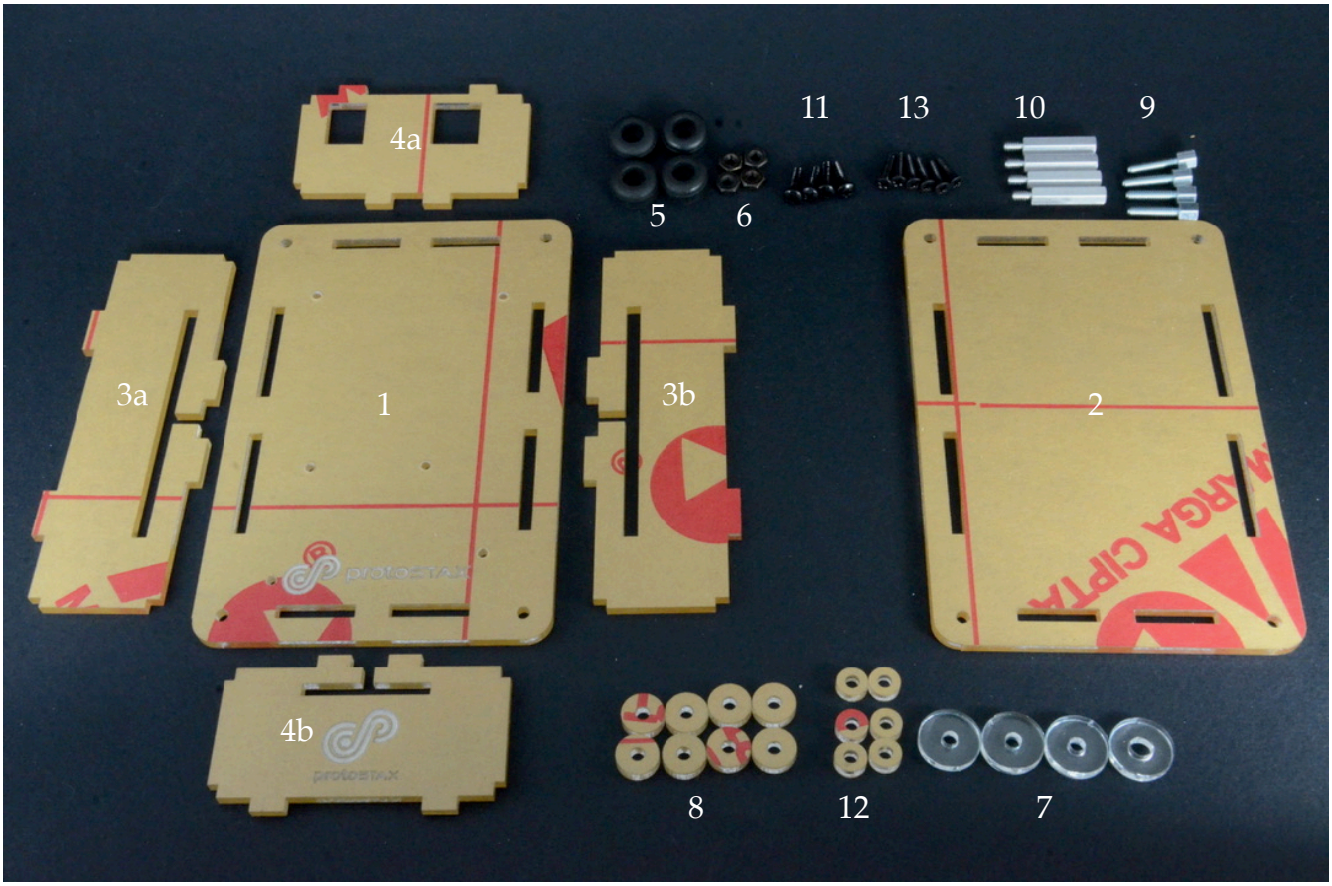
1. Introduction

ProtoStax enclosures are modular and stackable, allowing you to create endless combinations and configurations that evolve as your prototype evolves. Our revolutionary, patent-pending design allows you to plan your enclosure for the layout and functionality you'll need!

In this document, we'll show you how to get started with your ProtoStax enclosure. Of course, the configurations and build options shown are only suggested ones and some of the configurations - because ProtoStax enclosures are modular and stackable, the combinations and configurations are endless and you can also choose build orders to suit your own taste!

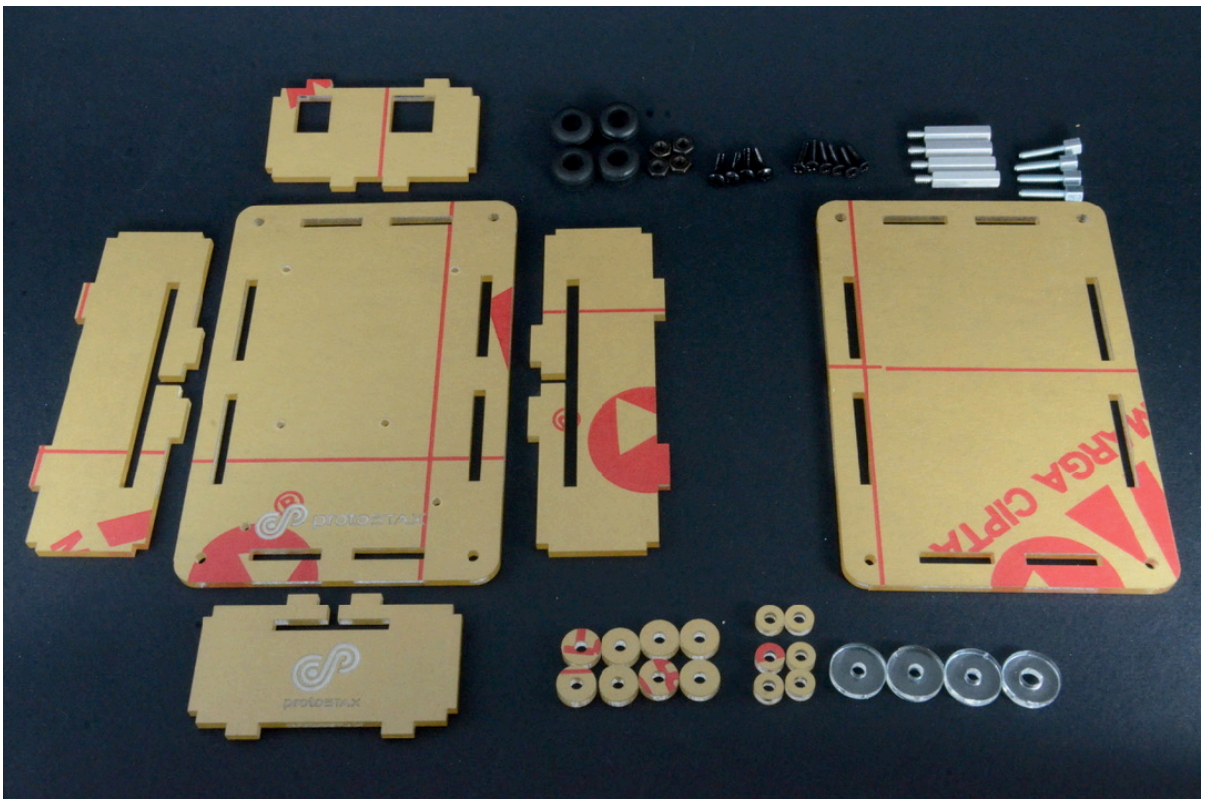
2. Parts List



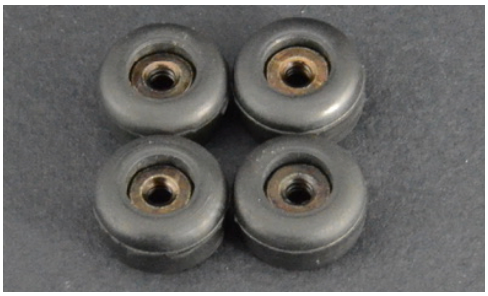
1) Base Plate - 1x
1) Top Plate - 1x
3a) Long Side Wall 1
3b) Long Side Wall 2
3c) Long Side Wall 3 (on some models)
4a) Short Side Wall 1
4b) Short Side Wall 2
5) Rubber Feet - 4x
6) Hex Nuts - 4x
7) Washers for Rubber Feet - 4x
8) Vertical Bracing Spacers - 8x
9) Vertical Bracing Lower Element - 4x
10) Vertical Bracing Upper Element - 4x
11) Top Screws - 4x (#4-40 screws - these are a litte bigger than the PCB mounting screws)
12) PCB spacers (where applicable; number varies)
13) PCB mounting screws (where applicable; number varies) (M2.5 screws - these are a little more slender than the top screws. They can either be black or silver.)

3. Instructions

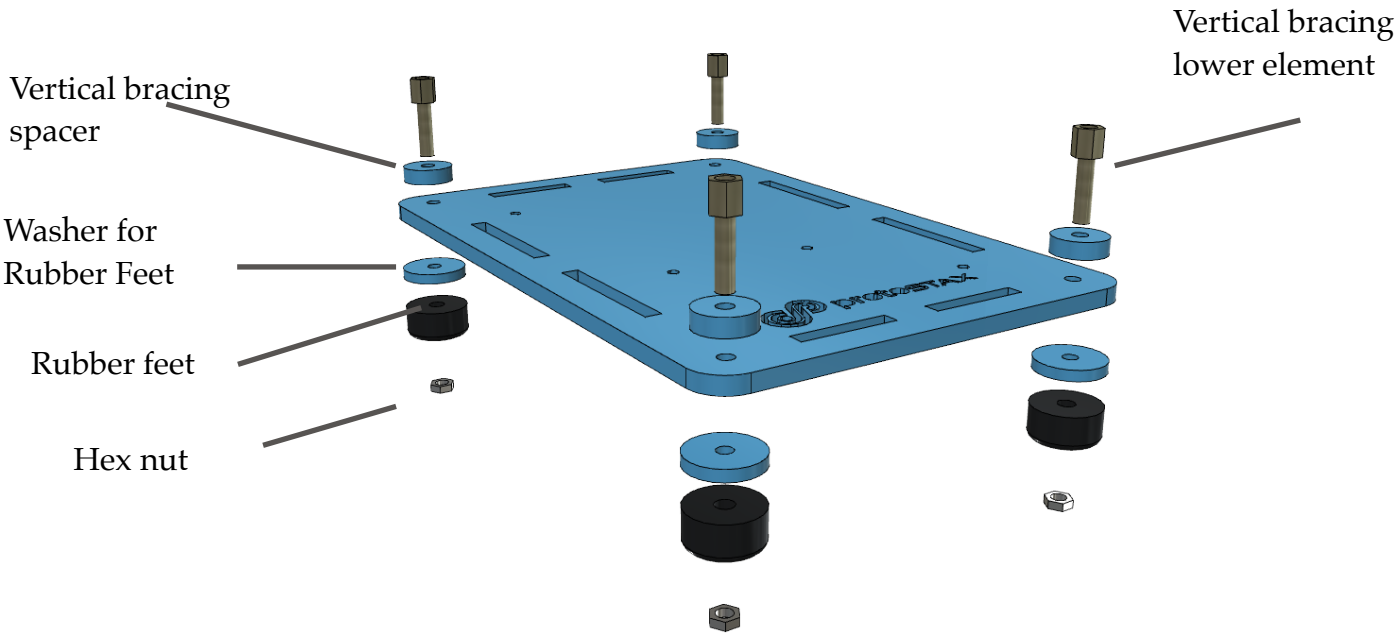
1. ProtoStax enclosure acrylic pieces are shipped with a protective backing on either side, which will help to keep the finish pristine for you until you are ready to use it! Remove the protective backing from your enclosure pieces. The actual parts may vary from the image shown below, depending on your ProtoStax Enclosure. The example shown below is for ProtoStax for Arduino.



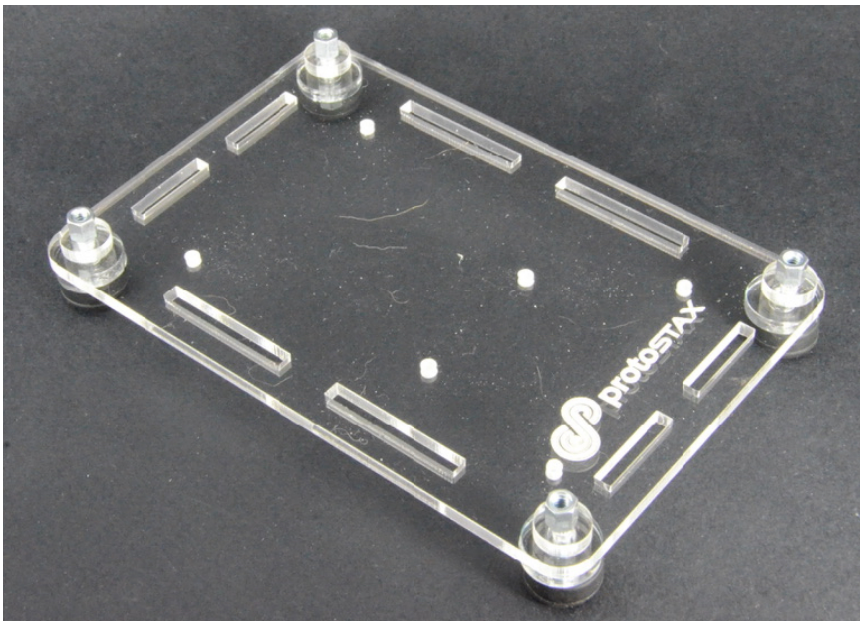
2. Start off by inserting the hex nuts into the bottoms of the rubber feet - you can press them down with a Phillips screw-driver gently so they fit in snugly.



3. Attach the rubber feet to the bottom of the bottom plate using the rubber feet (with hex nuts inserted in them), rubber feet washers, and spacers and bottom bracing elements above the bottom plate screwed into the hex nut) as shown below.



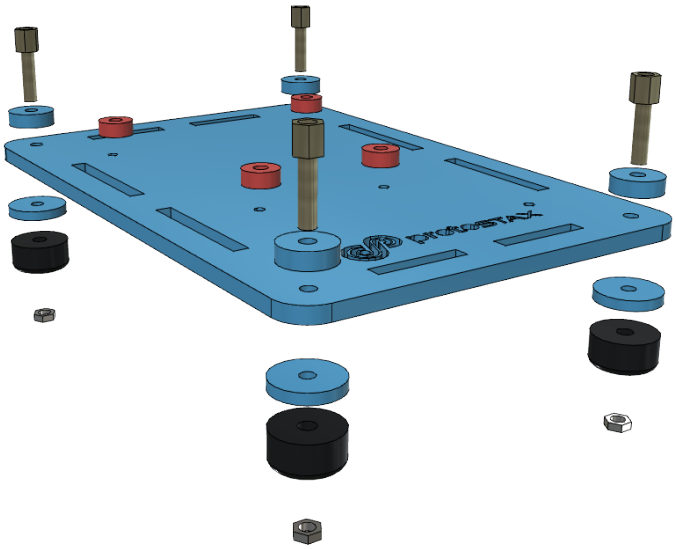
This is what it looks like when done!

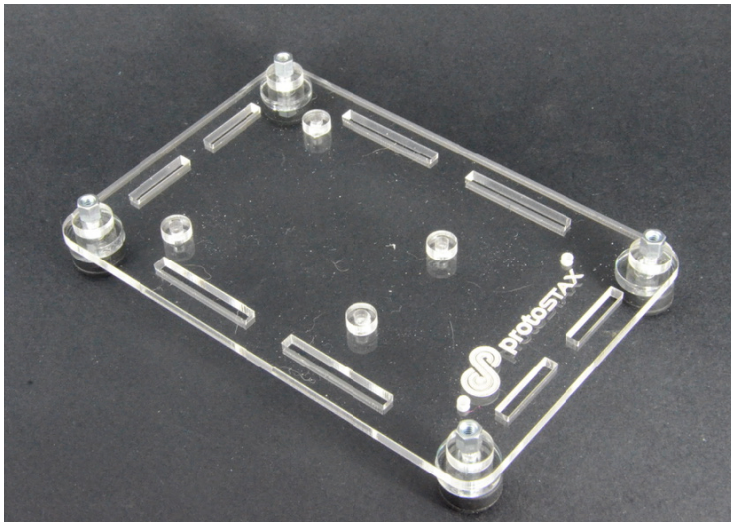


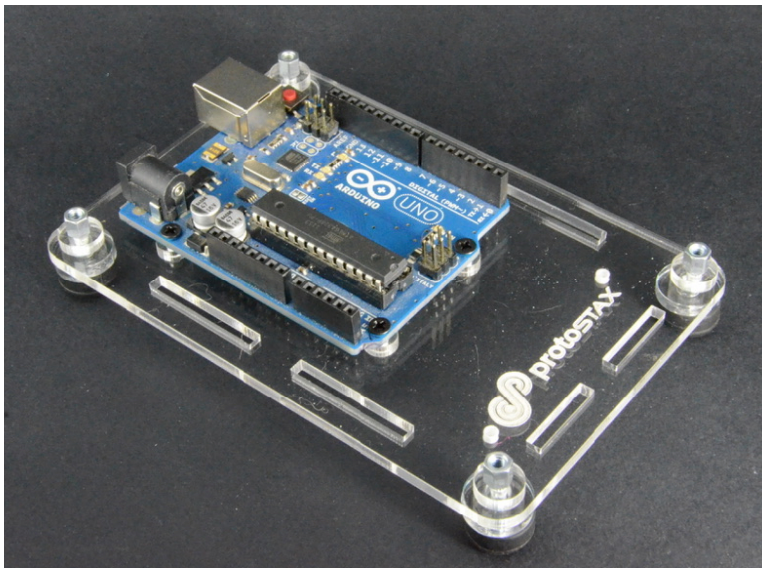
Platform Configuration

4. You can use the PCB spacers over the mounting holes, and place your board in question to line up with the mounting holes. You can then use the provided machine screws to mount the board to the bottom plate. The mounting holes are threaded, so you don't need any extra nut below. Please note that the PCB mounting screws are a different size (M2.5) than the top screws (which are #4-40). Please make sure you use the correct ones. The screws can all be hand screwed, so if is it too tight, it is not the right screw.

[Note: However, in the event that you damage the thread, you can still secure the board to the bottom plate by using a hex nut below the mounting hole. Also, in the event that you would like a bigger mounting hole than is provided, for instance, you can always drill a bigger hole and use the appropriate screw, along with a nut (or thread the acrylic for your bigger screw size if you have the appropriate screw tapping set).]



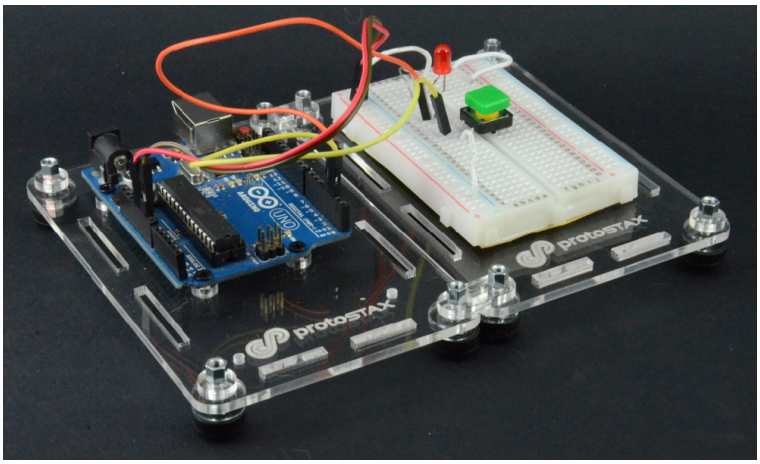




This is what it looks like with your board mounted to the base plate using the PCB spacers and PCB mounting screws!

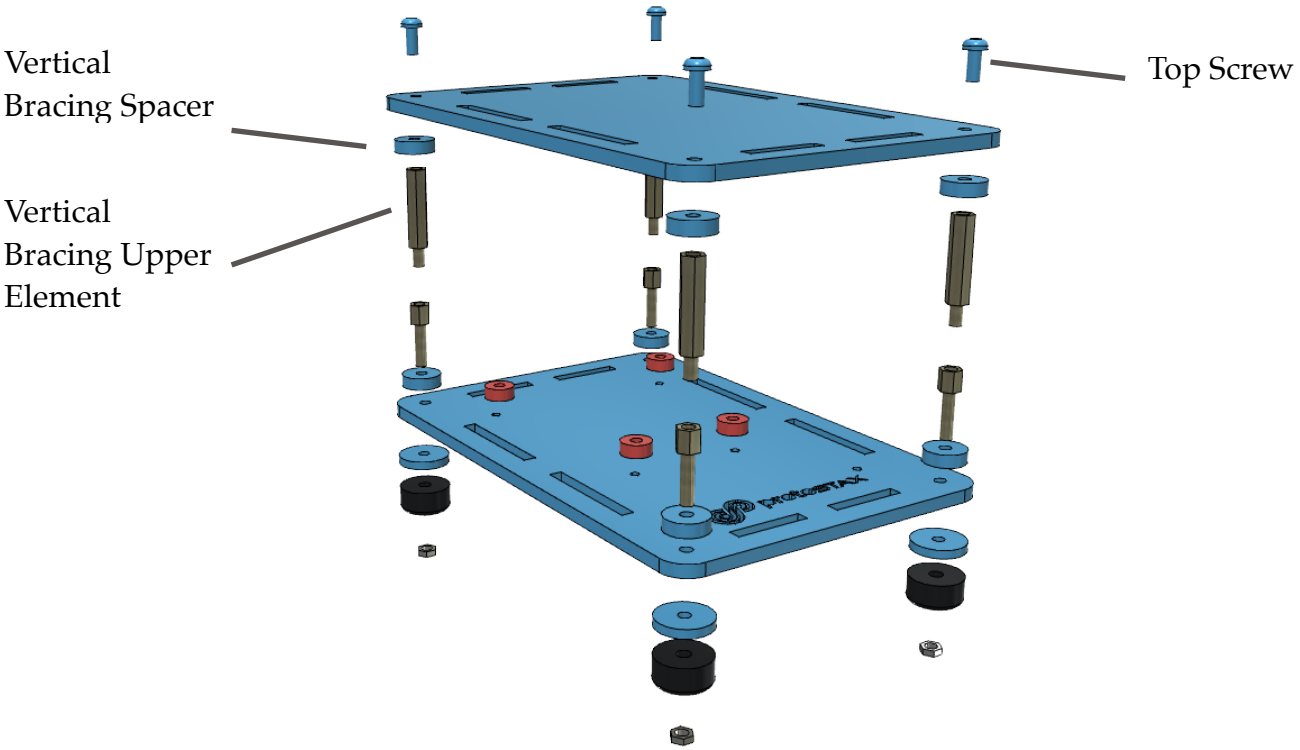
This is what we call *Platform Configuration*! You have your board mounted firmly on the base plate, and have it protected and elevated by rubber feet (and protect the surfaces of your tables from scratches from the bottom of your board too! :-)) . This configuration gives you full and open access to your board as you start prototyping!

[Note: Not to get ahead of ourselves, but just wanted to quickly point out that with horizontal stacking (which we'll introduce a little later on), you can have one platform with an Arduino and another platform with a Breadboard stacked side-by-side in Platform Configuration. So the stable platform for prototyping can extend to any other boards you are using, and they can all be located next to each other and all mounted. There is no limit to the amount of horizontal (or vertical) stacking you can do , so that means whether you have 1 board or 10 in your project, you can mount them all together and prototype with all them as a single unit].

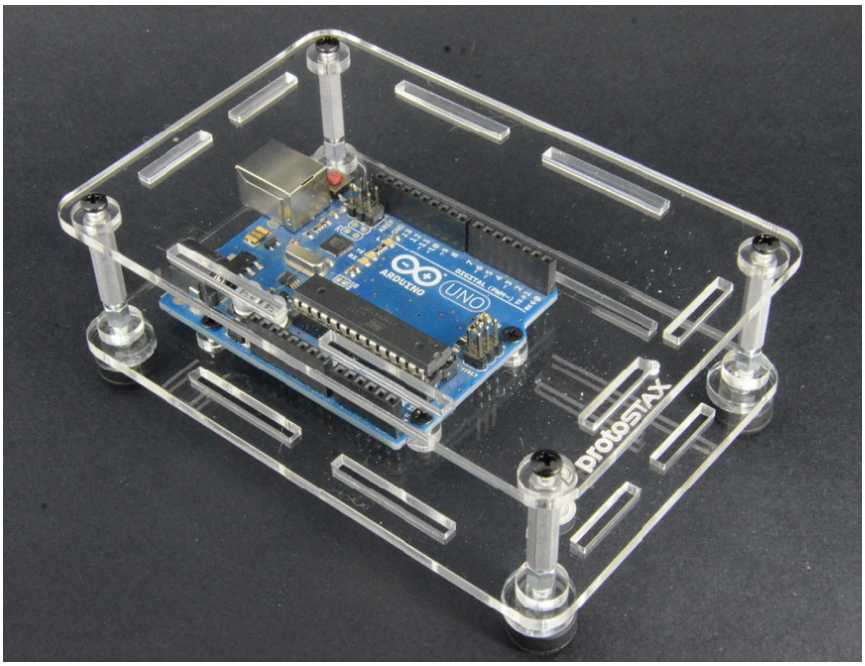


Open Configuration

5. Attach top bracing elements, top spacers, and top plate and secure with screws as shown below to form an Open Enclosure

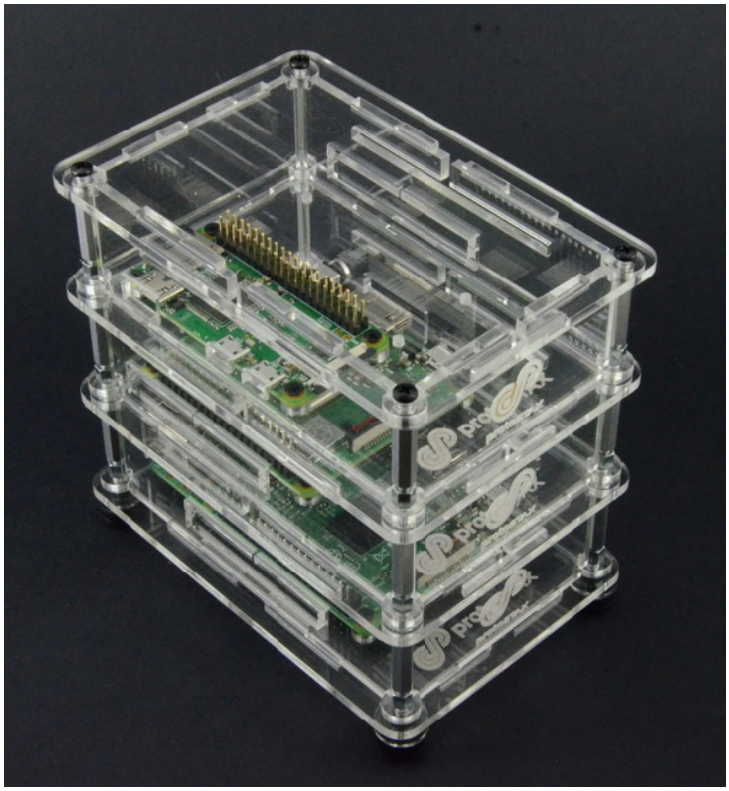


This is what is looks like when done!



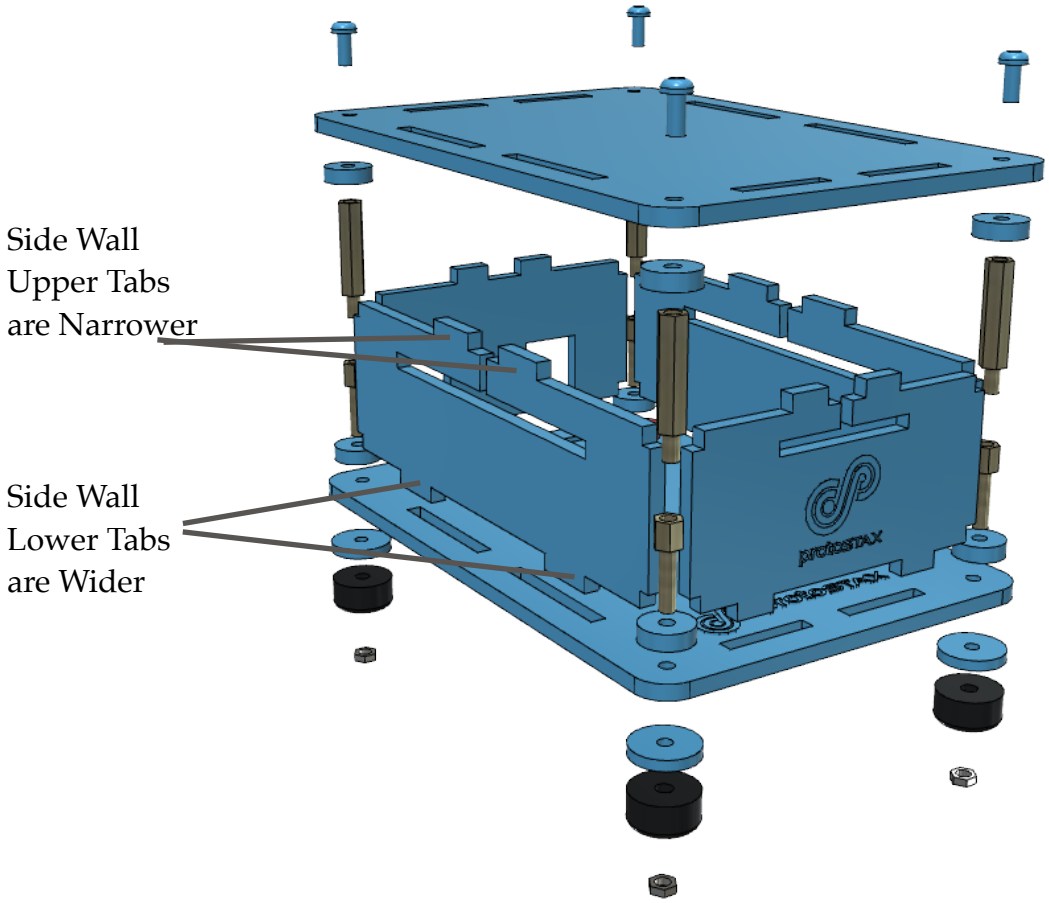
This is what we call the *Open Configuration*. In this configuration, you've added the upper vertical bracing elements and top of the enclosure, but have omitted the side walls. This configuration gives your prototype more protection than the Platform Configuration, while still giving you open access (from the sides) to your prototype, in case you need tweak or adjust some things, or for example, if your prototype is running a bit hot and can do with some extra airflow!

[Note: Once again, not to get ahead of ourselves here, but wanted to quickly point out here that with vertical stacking (which we'll introduce a little later on!), you can have a set of vertically stacked Open Configuration enclosures, like for example in a stacked Raspberry Pi Cluster. If your tower is getting too high, you can stack vertically as well as horizontally to reduce the height of the cluster. The Open Configuration cluster will definitely have more open air flow to help with passive cooling of your cluster.]

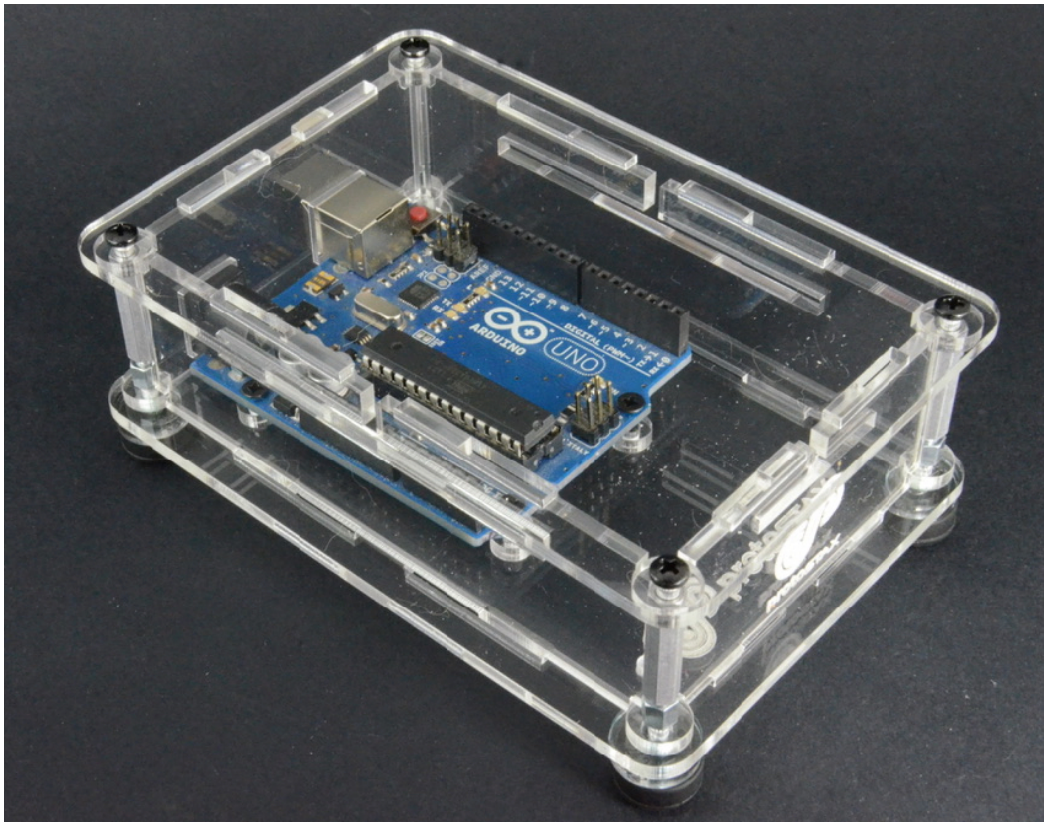


Closed Configuration

6. You can also include the side walls to form a fully Closed Enclosure. The side walls fit into the wall slots on the bottom and top plates. Note the proper orientation of the side walls for the cutouts to fit any plug and input points of the board. Also ensure that the side walls are oriented such that the lower tabs are the wider tabs, with the narrow tabs going towards the top of the enclosure (sometimes, especially when a side wall doesn't have any specific cutouts for a particular board, it is possible to insert the side wall in an upside-down way) - when you are vertically stacking enclosures, this orientation of the side walls will ensure that the side wall from the top will in the wall slots without any problems.

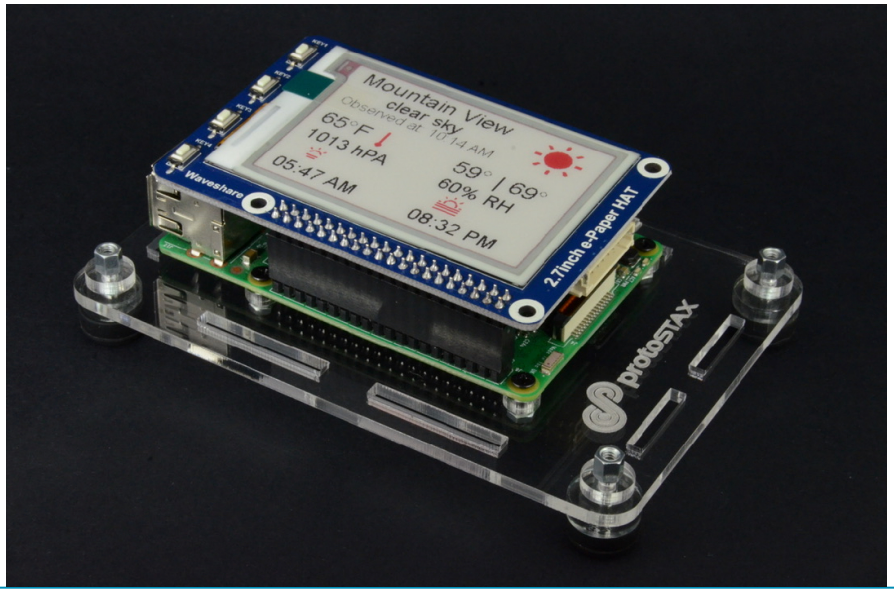


This is what it looks like when done!

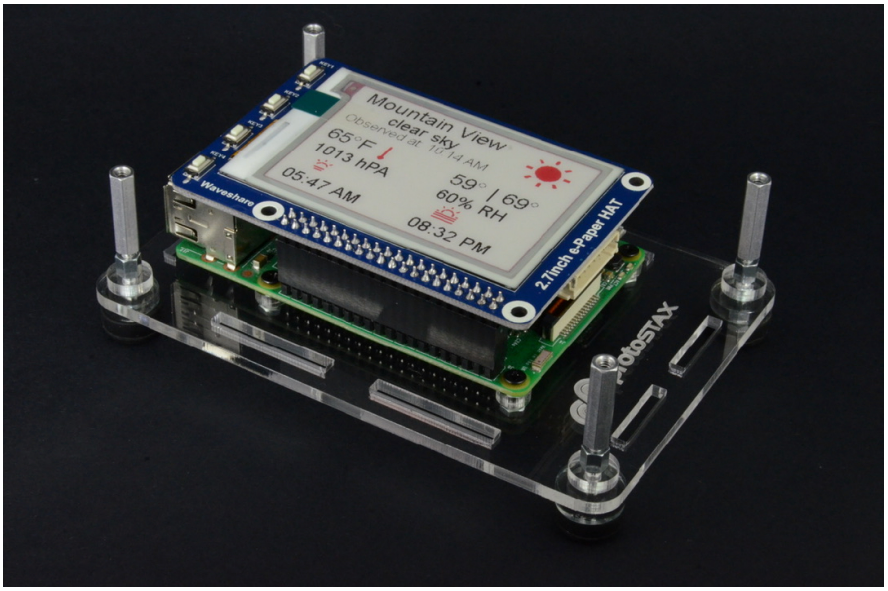


Assembly Tip!

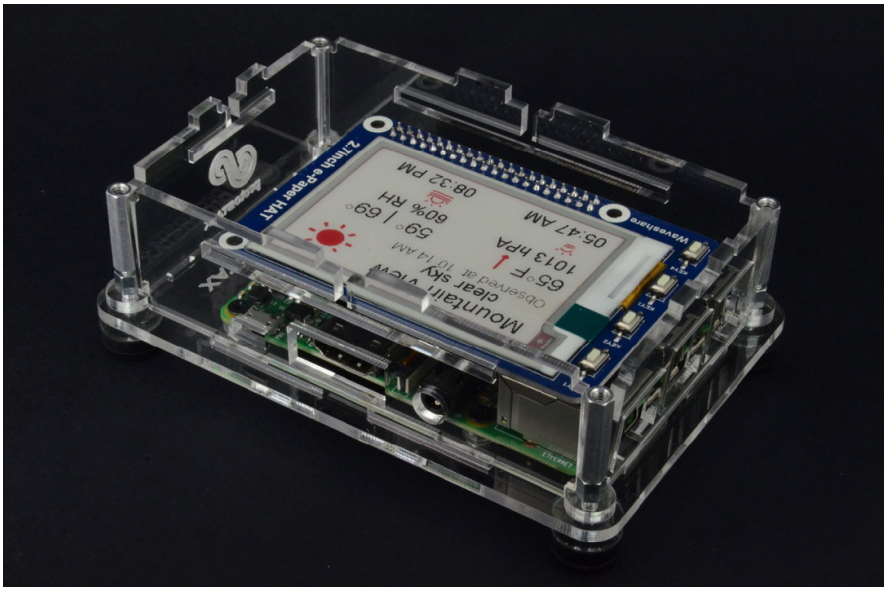
Start with Platform Config



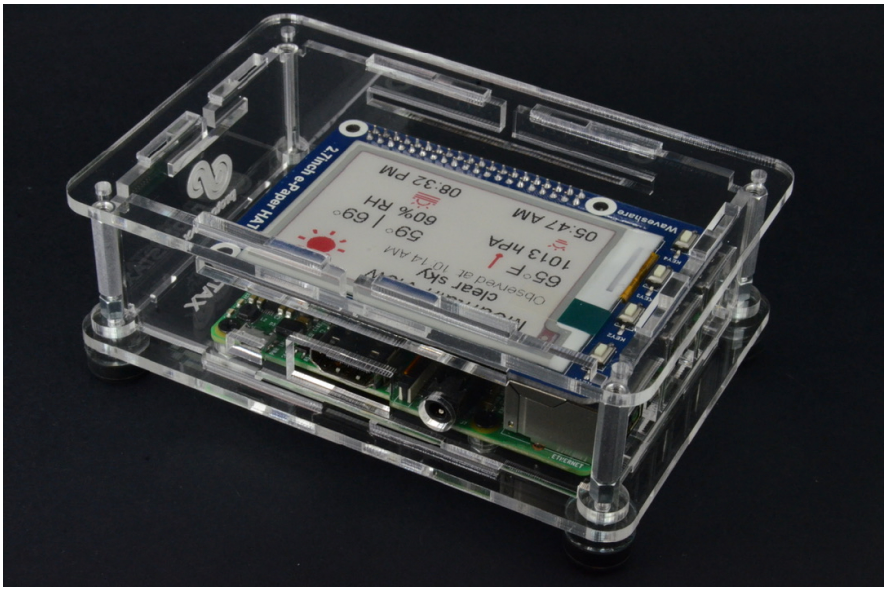
Add Vertical Upper Bracing Elements



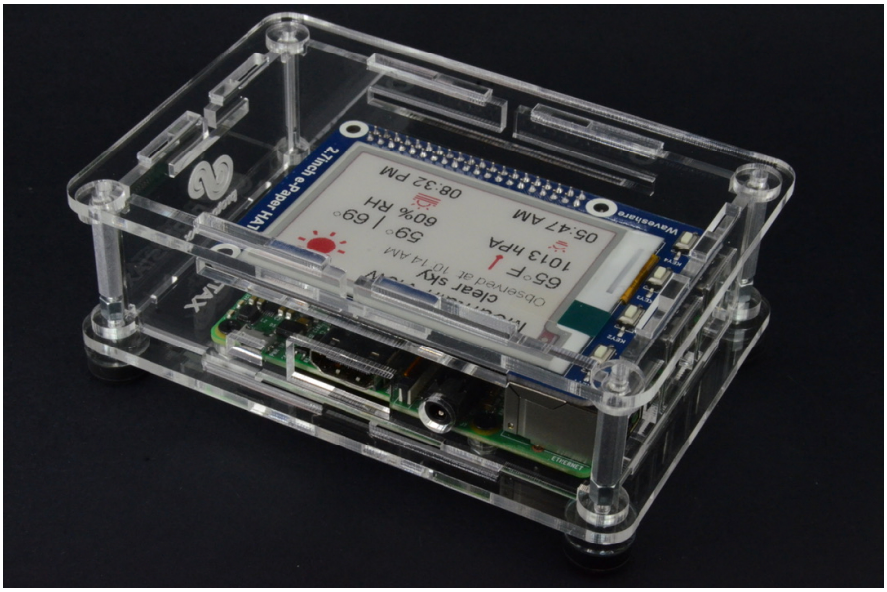
Add Side Walls (remember the orientation of the tabs - wider tabs fit into the lower base plate, and the upper tabs are narrower)



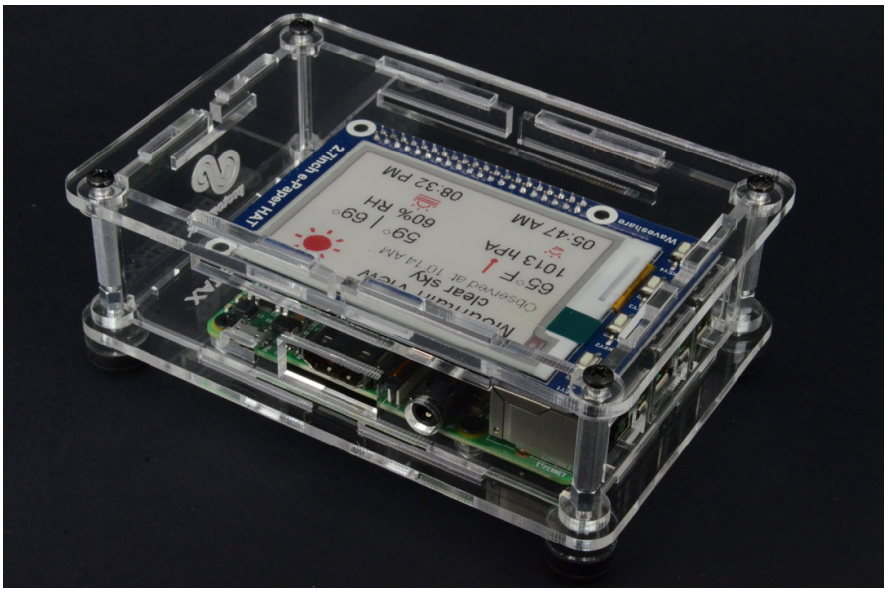
Add the Top Plate next. Make sure the upper tabs of the side walls fit into the wall slots of the Top Plate. The upper tabs of the side walls are cantilevered to allow for cables to be inserted into the cable management slots (in most cases, the walls have cable management slots at the top. It is only in some cases that they don't have the slots). Twisting the upper tab's cantilever excessively can cause it to snap off. Once the side wall's upper tabs are firmly seated in the wall slot, this twisting is no longer a concern as the side wall provides rigidity to the top plate and the top plate in turn protects the tabs of the side walls. However, be careful during installation when you are trying to line up the side walls' tabs and the wall slots, to prevent damage!



Insert the upper vertical bracing spacers into the gaps between the Vertical Bracing Upper Elements and the Top Plate. It is easier to do this once the Top Plate is in place, even though the vertical bracing spacers fit below the Top Plate!



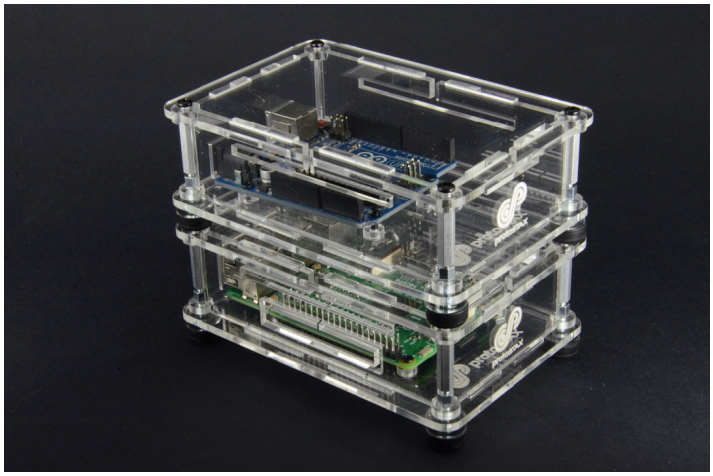
Lastly, insert the top screws and screw them into the Vertical Bracing Upper Elements to finish your enclosure!



This is what we called the Fully *Closed Configuration,* which provides maximum protection for your board. Our beautiful, elegant enclosures are not just functional but great-looking, light-weight, and offer considerable protection for your electronic devices!

The enclosure has about 1.2 inches of vertical clearance internally, which means you'll have ample room for an Arduino Shield or a Raspberry Pi HAT/pHAT/Bonnet. You might even be able to squeeze in two Shields if the lower Shield is lower profile and the upper Shield is flush and does not use female headers.

Lastly, finished ProtoStax enclosures are themselves stackable one on top of the other for storage! The holes on the rubber feet of the upper enclosure fit into the top screws of the lower enclosure. Yes, we love paying attention to little details! 😊



4. Horizontal Stacking

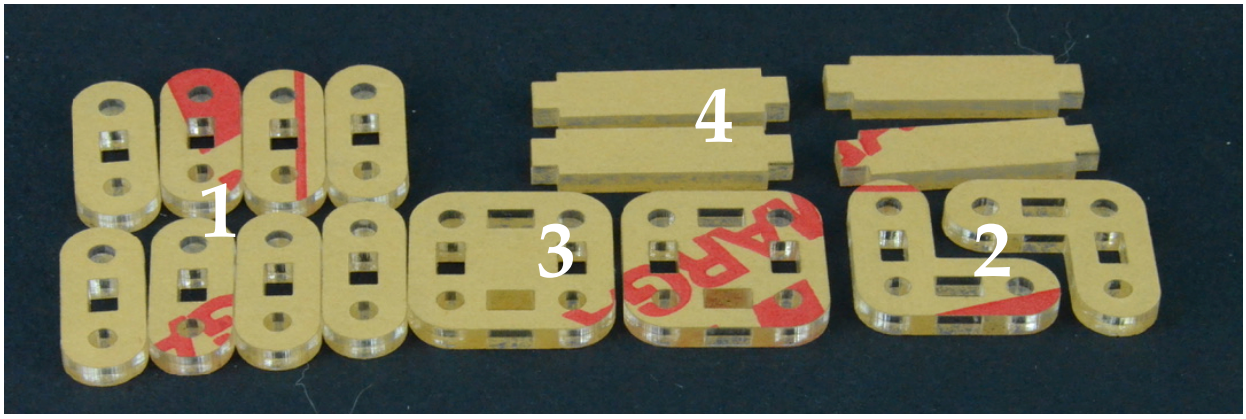
We know your project/prototype usually consists of more than just a single Arduino or Raspberry Pi - you will usually have some components and circuitry on a breadboard, or may have other custom boards that you want to integrate with. That is why we decided that ProtoStax enclosures need to be stackable! You can stack different enclosures side-by-side (horizontally) to make a larger enclosure! There is no limit to the amount of horizontal stacking that you can do! So let your imagination run wild as you create ever more sophisticated and complex prototypes, and ProtoStax will try its hardest to keep up with you!

We talked about the 3 main configurations earlier in the context of a single enclosure - Platform Configuration, Open Configuration, and Closed Configuration.

The same ideas can be applied to multiple enclosures connected together.

[Note: Because ProtoStax enclosures are modular, one of your sub-enclosures can be in one configuration and another can be in a different configuration. But again, we're getting a little ahead of ourselves here! 😊]

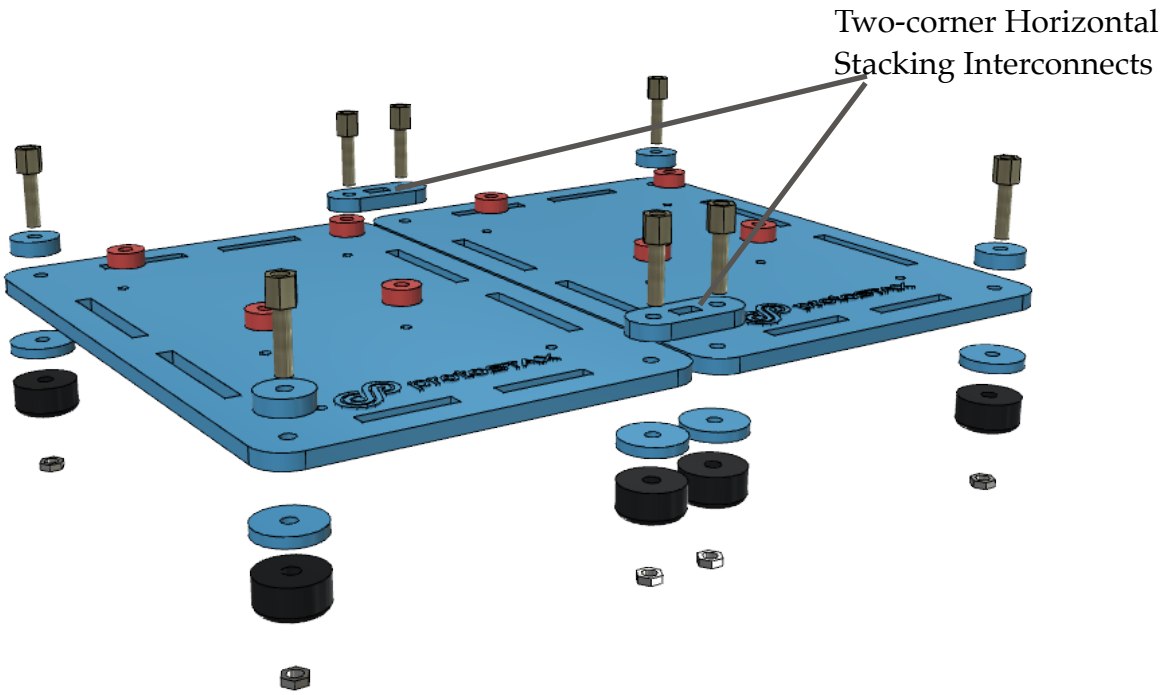
When we talk about Horizontal Stacking, we first need the Horizontal Stacking Kit. Here are the parts that come with it:



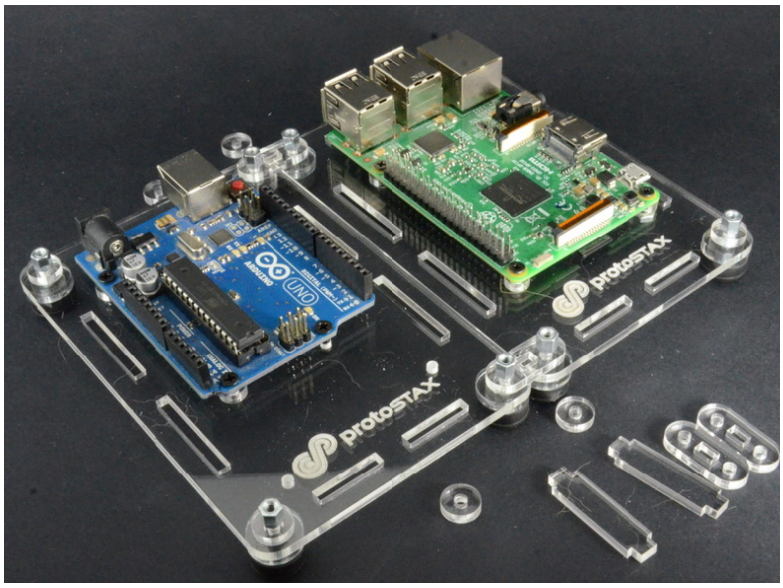
1) Two-corner Horizontal Stacking Interconnects - 8x
2) Three-corner Horizontal Stacking Interconnects - 2x
3) Four-corner Horizontal Stacking Interconnects - 2x
4) Side Wall for Horizontal Stacking Interconnect - 4x

Platform Configuration

You can start off your horizontally-stacked enclosures in a Platform Configuration much like you did for your single enclosure. The assembly is very simple - just replace the lower Vertical Bracing Spacers where the two enclosures' Base Plates corners meet with a Two-corner Horizontal Stacking Interconnect, as shown below!



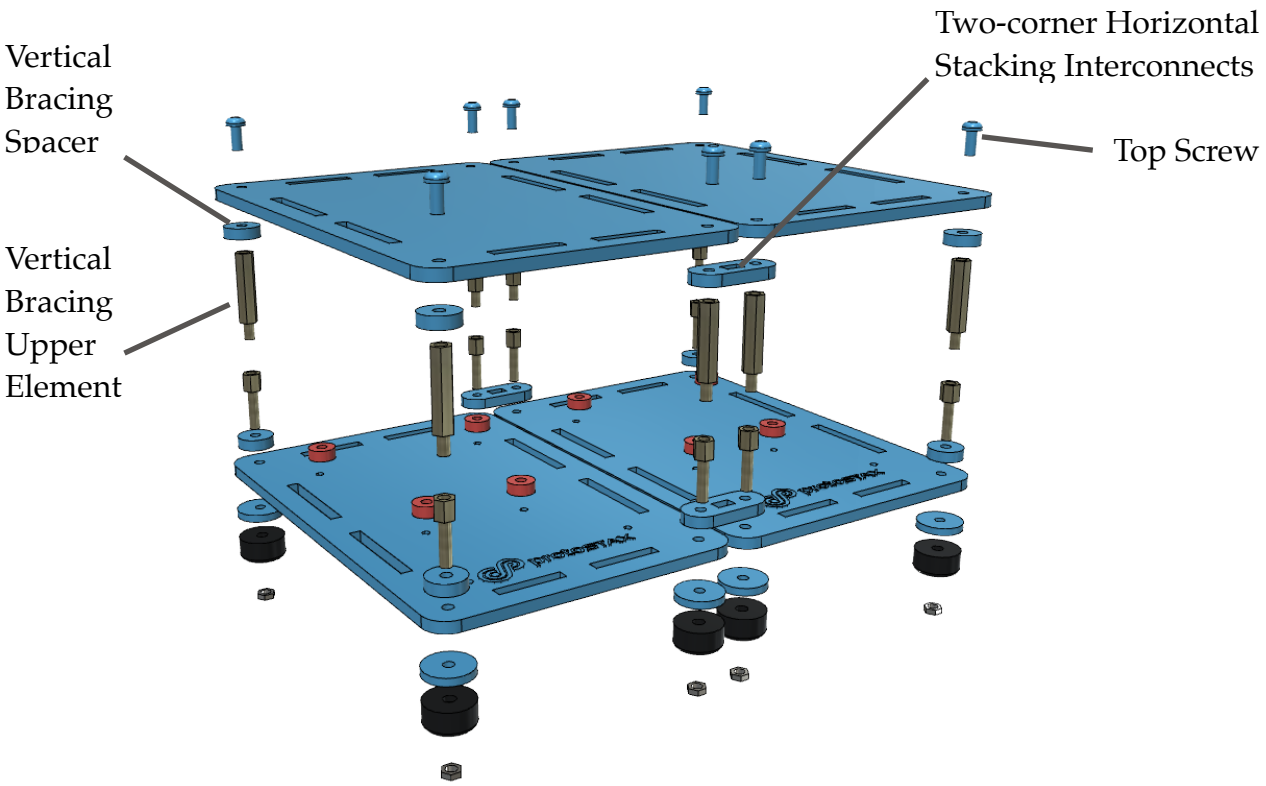
So if you already have two enclosures in Platform Configuration, say for example one with an Arduino Uno and the other with a Breadboard, you can first decide how you're going to stack them side-by-side - along the length, or along the width. Where the two corners would meet, unscrew the Vertical Bracing Lower Elements, replace the Vertical Bracing Lower Spacers with Two-Corner Horizontal Stacking Interconnects, and screw the Vertical Bracing Lower Elements back in! Voila! Easy peasy lemon squeezy, as some might say! 😊



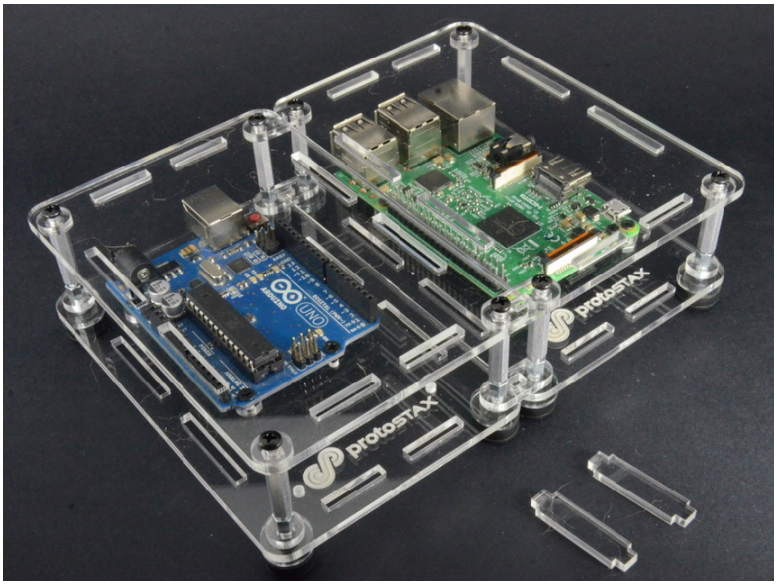
This is what it looks like when done!

Open Configuration

Similar to the Open Configuration for a single enclosure, you can add the Upper Vertical Bracing Elements and Tops to finish an Open enclosure that is without the side walls. Attach top bracing elements, top spacers, and top plate and secure with screws as shown below to form an Open Enclosure.



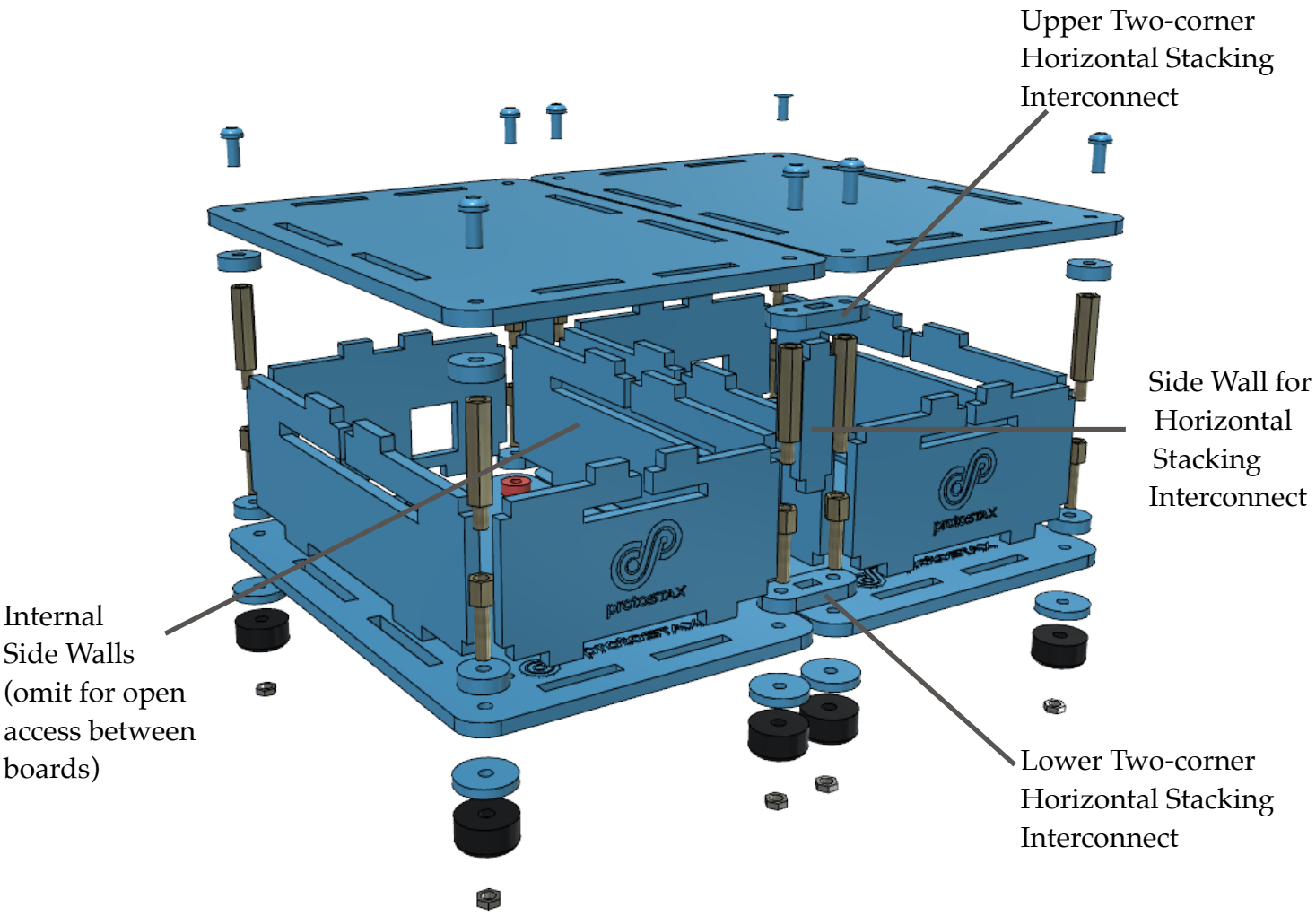
This is what it looks like when done!



Closed Configuration

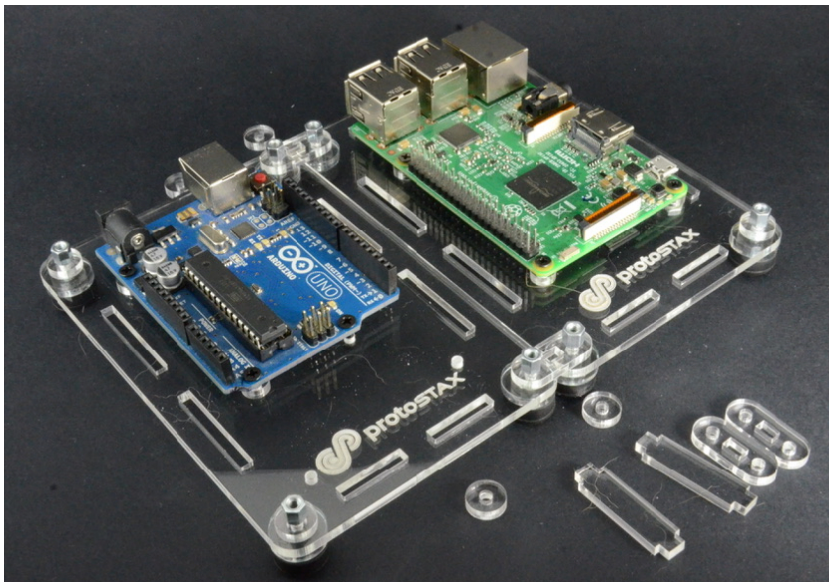
You can have a Closed Configuration for horizontally stacked enclosures in a manner similar to Closed Configuration for a single enclosure, with a couple of additional wrinkles to keep in mind. If you haven't already done so, now would be a good time to read about the Closed Configuration for a single enclosure described above, as well as the Assembly tips that were presented there!

Note the orientation of the side walls when inserting - lower tabs are wider than the upper tabs, as described before. When you add the side walls, you will notice that there is a gap along the edge where the two enclosures meet. This is where the Side Wall for Horizontal Stacking Interconnect would fit in! It fits into the slots present in the upper and lower Horizontal Stacking Interconnects (Two-corner, Three-corner or Four-corner - in our example below, we use Two-corner interconnects as only two corners meet).

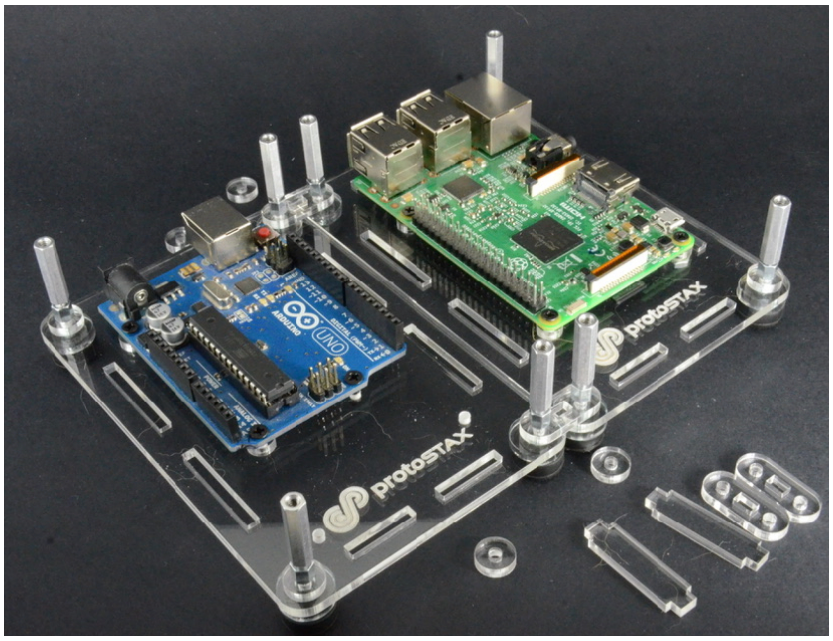


Assembly Tip!

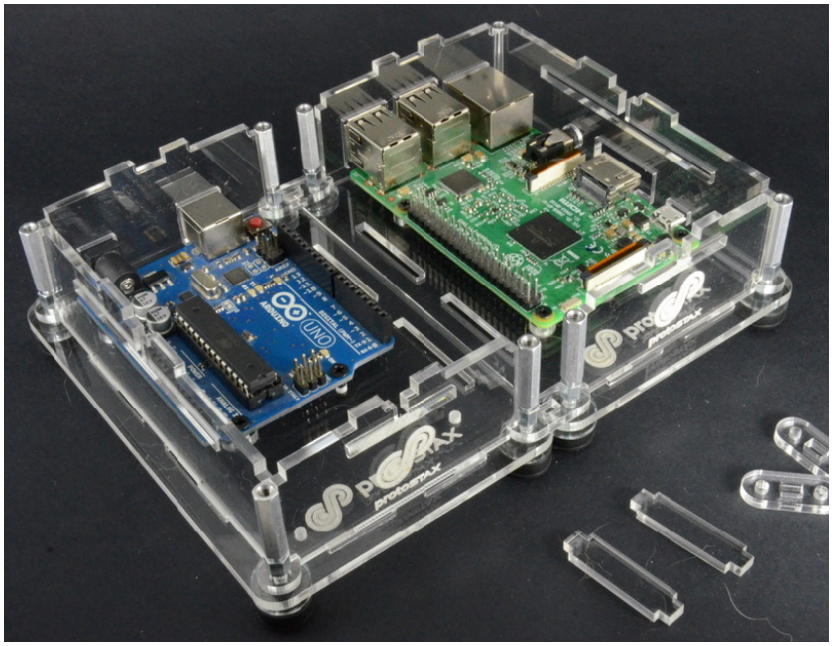
Start off with Plaform Configuration



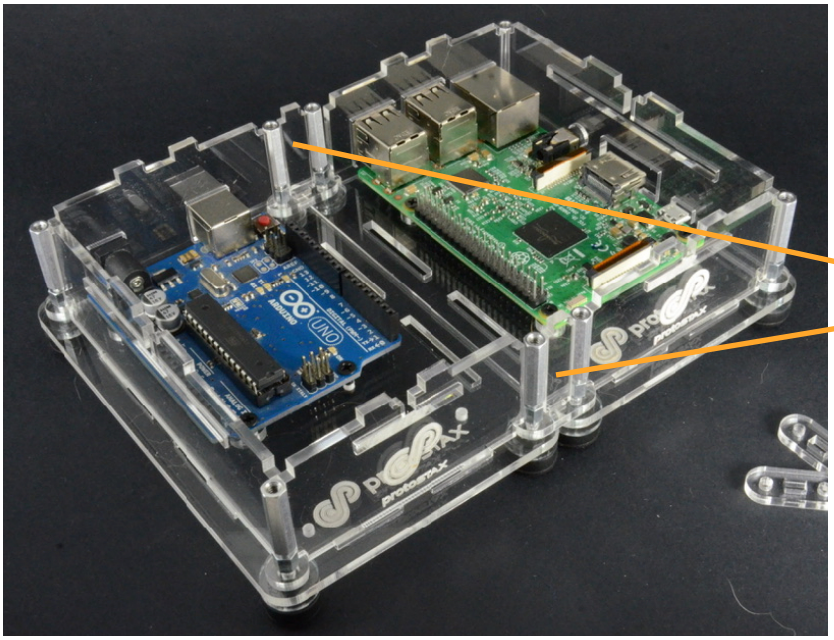
Add the Vertical Bracing Upper Elements



Add the side walls. In the example below, the internal side walls have been omitted. You can add them if you like.

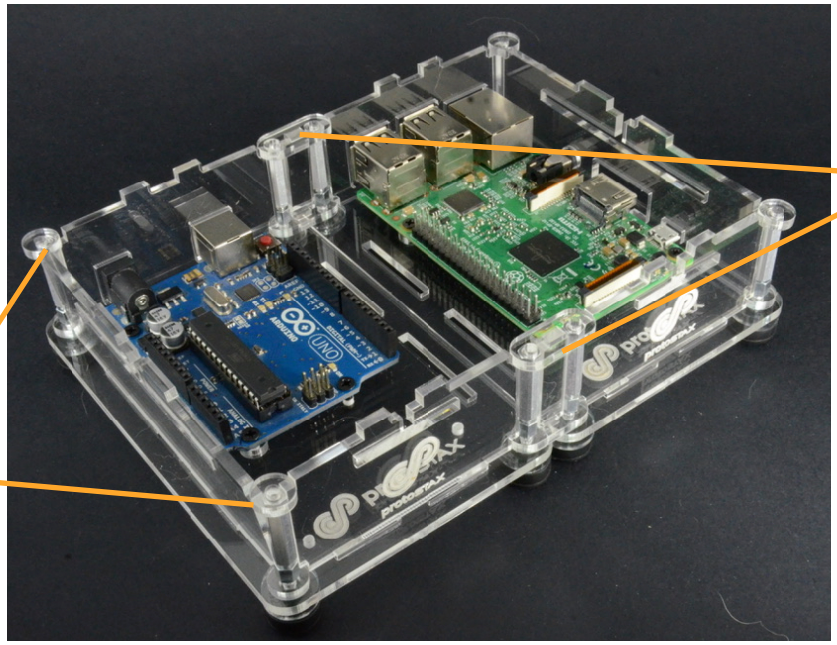


Add the Side Walls for the Horizontal Stacking Interconnects

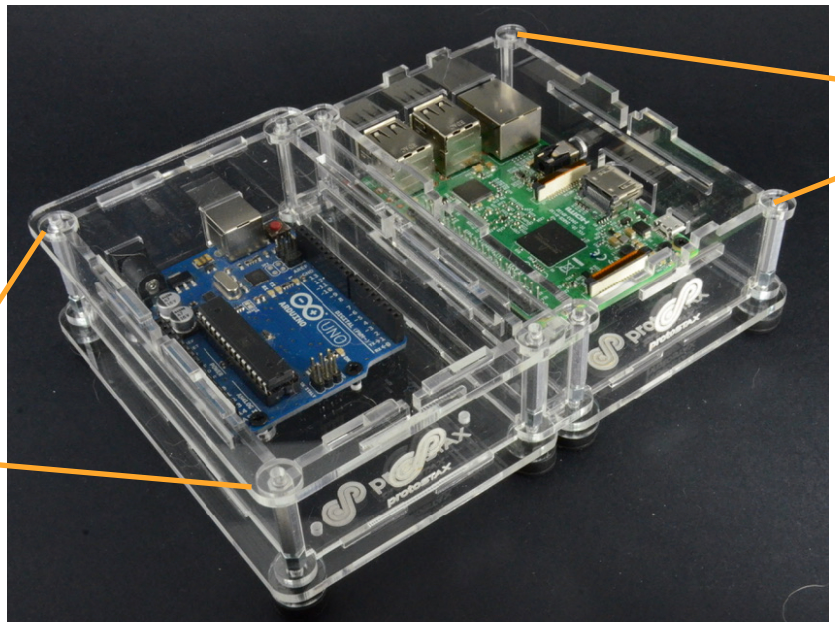


Side Walls for Horizontal Stacking Interconnects

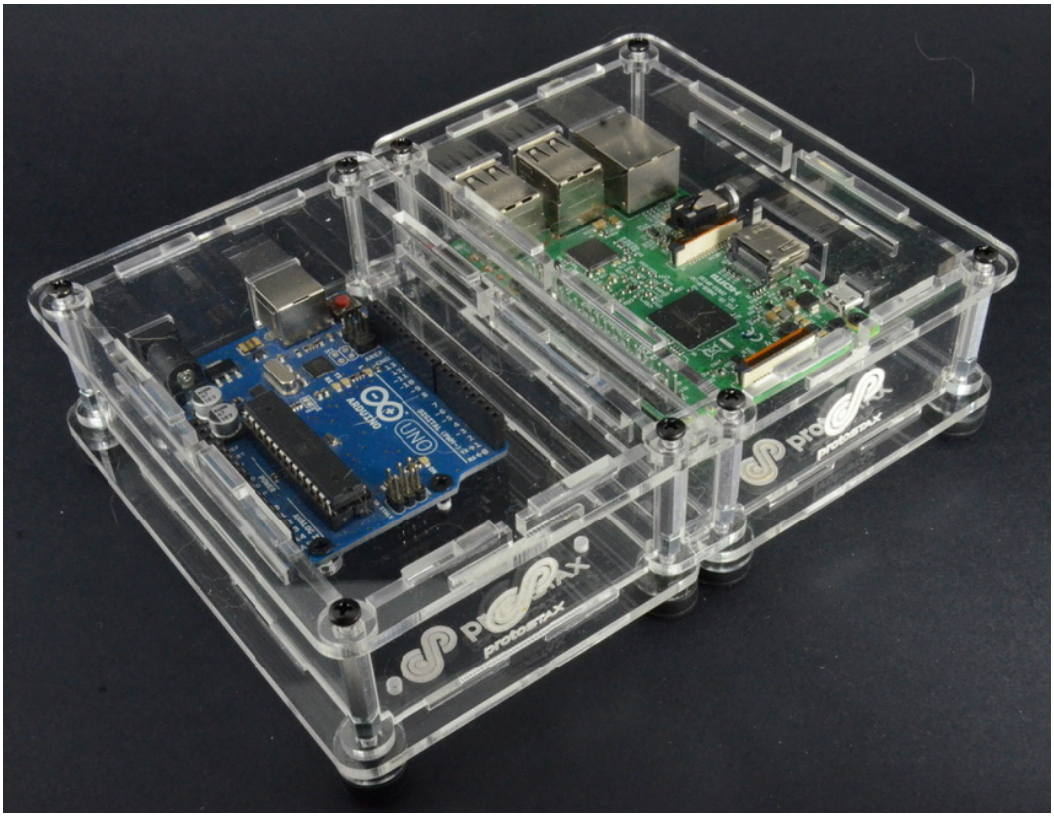
Add the Two-corner Horizontal Stacking Interconnects (Ignore the Upper Vertical Bracing Spacers shown - you can place them later - it's easier that way)



Place the top plate, carefully fitting the side wall tabs into the wall slots, taking care not to bend the cantilever of the side wall tabs too much as you adjust them into position. Then add the Upper Vertical Bracing Spacers by inserting them into the space between the Vertical Bracing Upper Elements and the Top Plate.



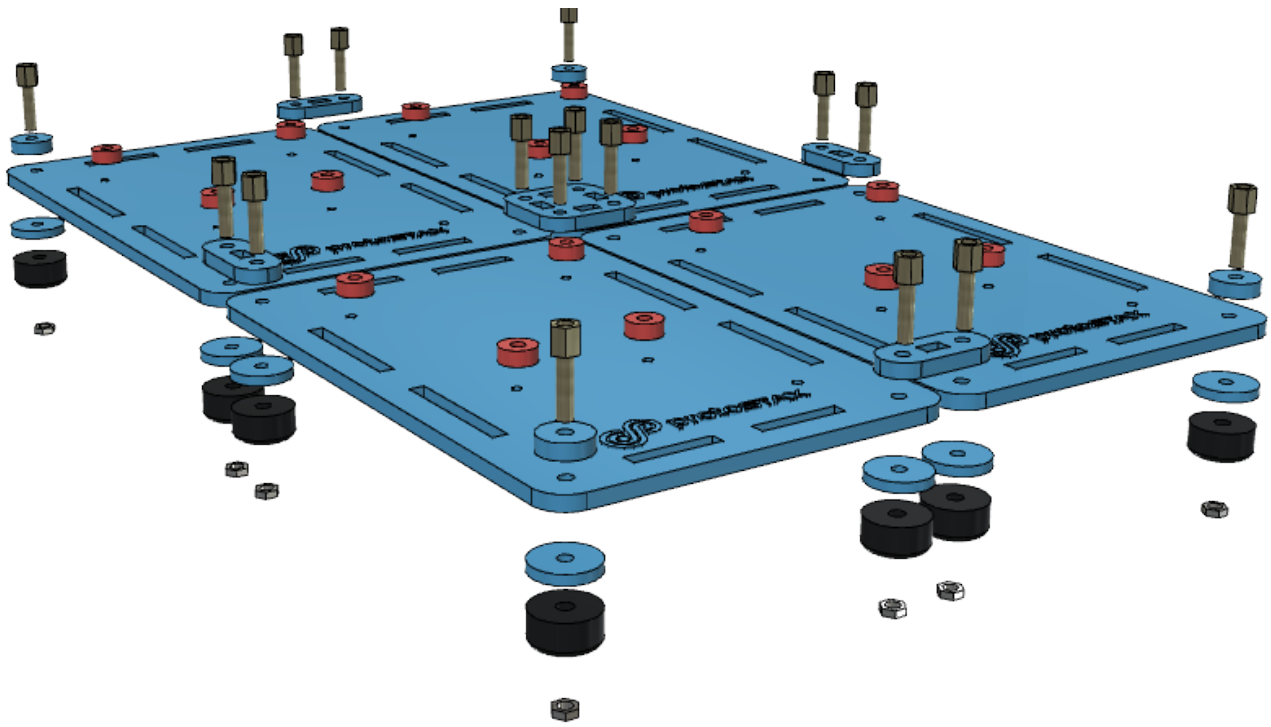
Repeat on the other side. Insert top screws and screw into the Vertical Bracing Upper Elements to finish the enclosures! You have an enclosure now that is 2x the side and can accommodate an Arduino and a Raspberry Pi and any wiring between them! (Or an Arduino and Breadboard, or Raspberry Pi and Breadboard, or any combinations of your choosing!)



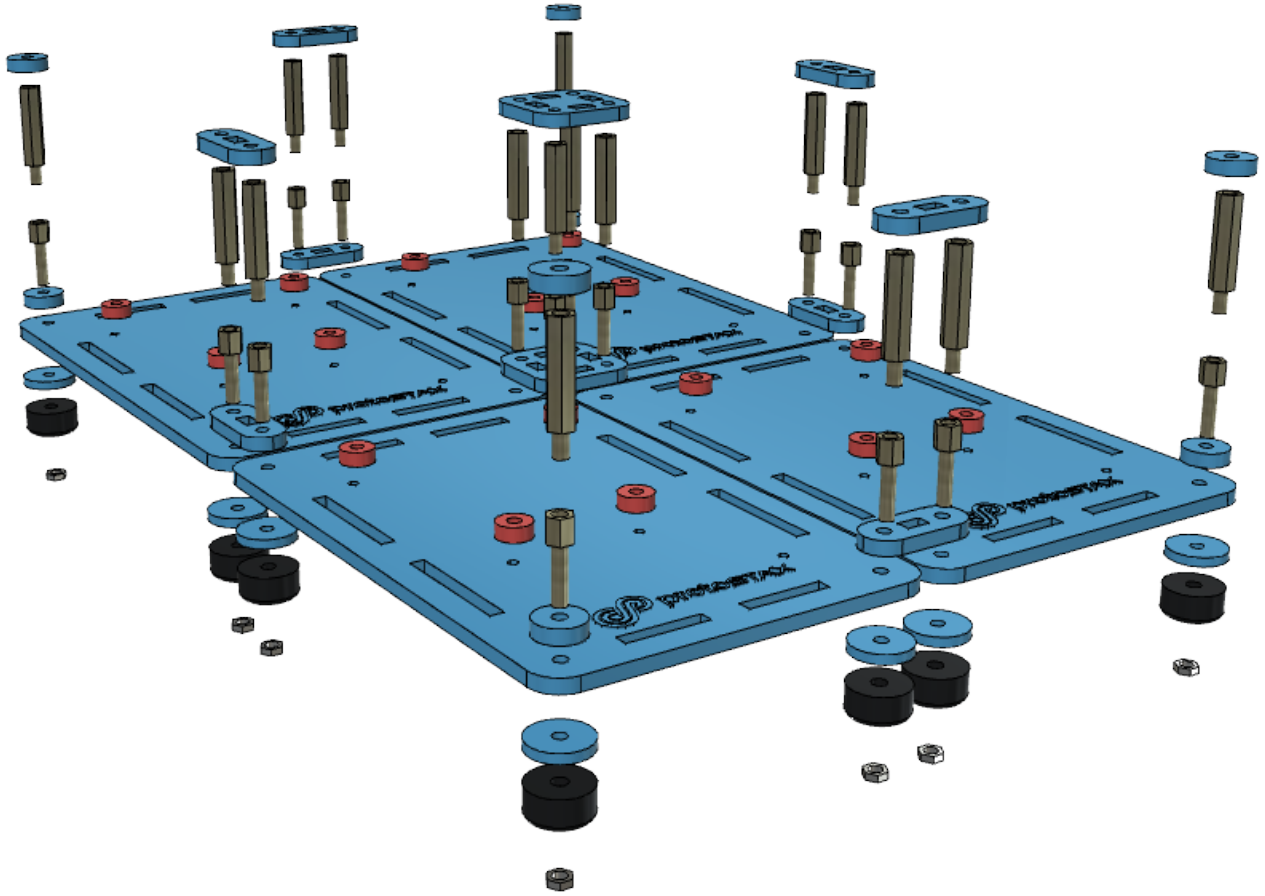
Horizontally Stacking 4 enclosures

The same concept can be used to stack more enclosures side-by-side. In the examples below, we show 4 enclosures being horizontally stacked, in the Platform, Open and Closed Configurations. In the center, where 4 corners from the 4 enclosures meet, we use a Four-corner Horizontal Stacking Interconnect. Elsewhere, where two corners meet, we use Two-corner Horizontal Stacking Interconnects.

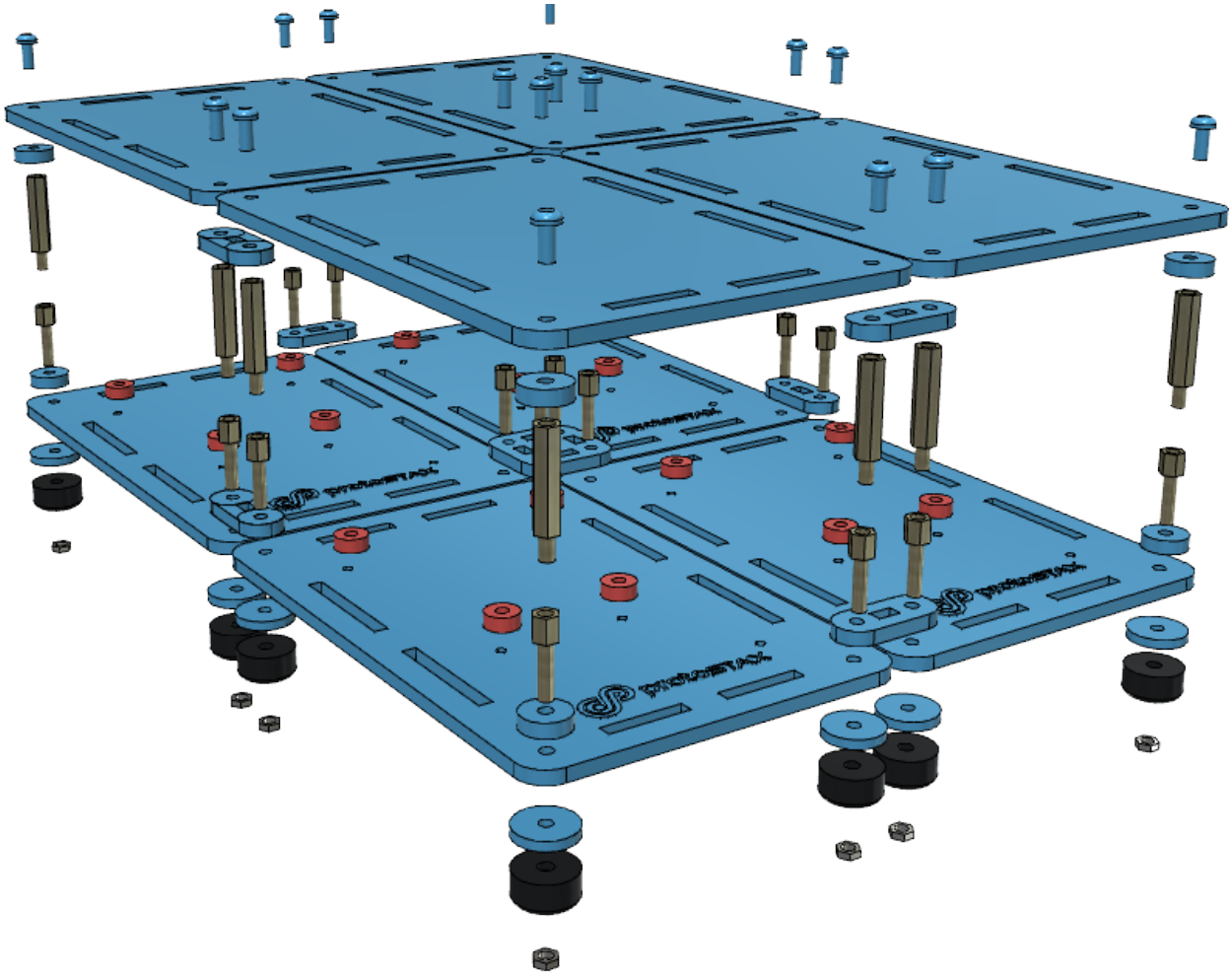
Platform Configuration



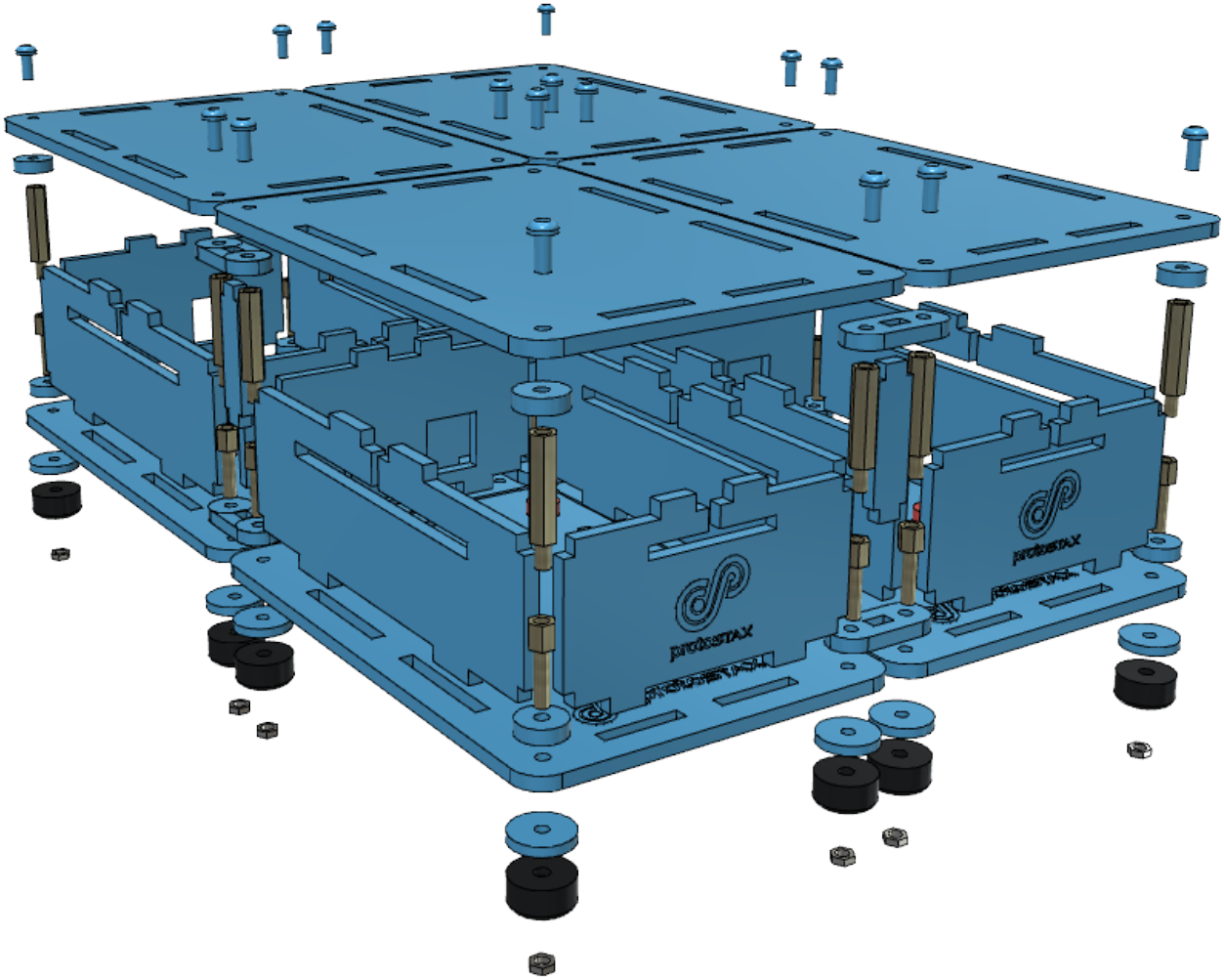
Open Configuration (without showing the Top Plate, so you can see the positions of all components)



Open Configuration, shown with Top Plates in place.



Closed Configuration.

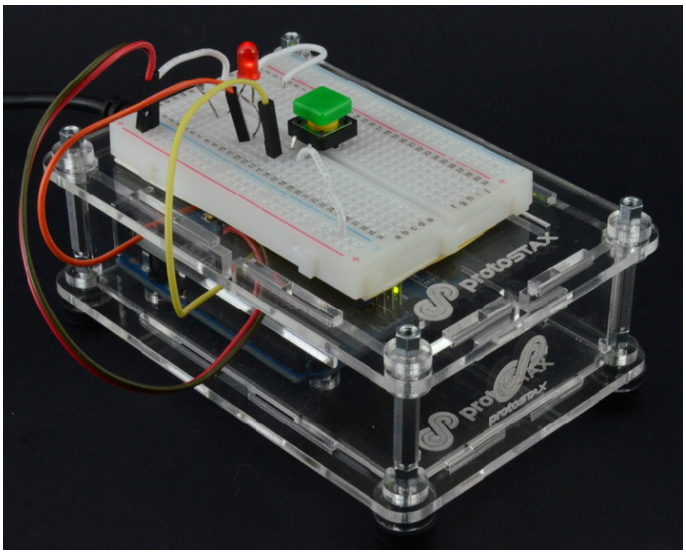


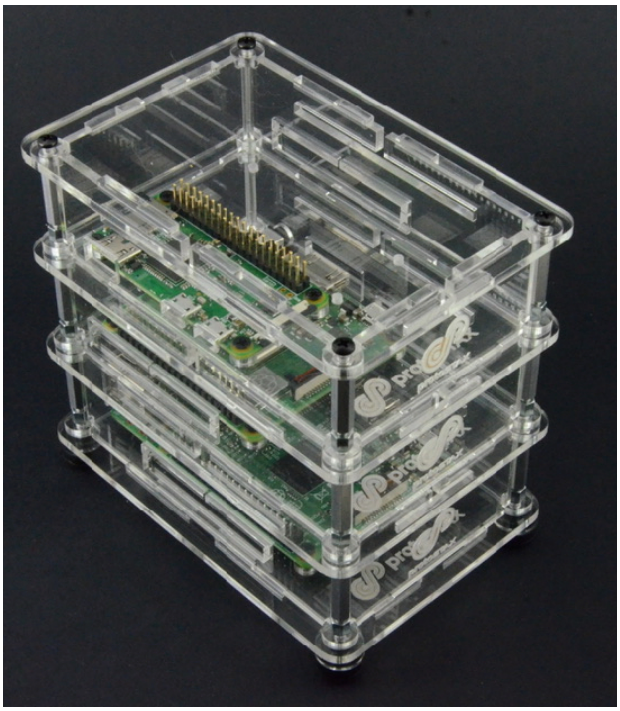
5. Vertical Stacking

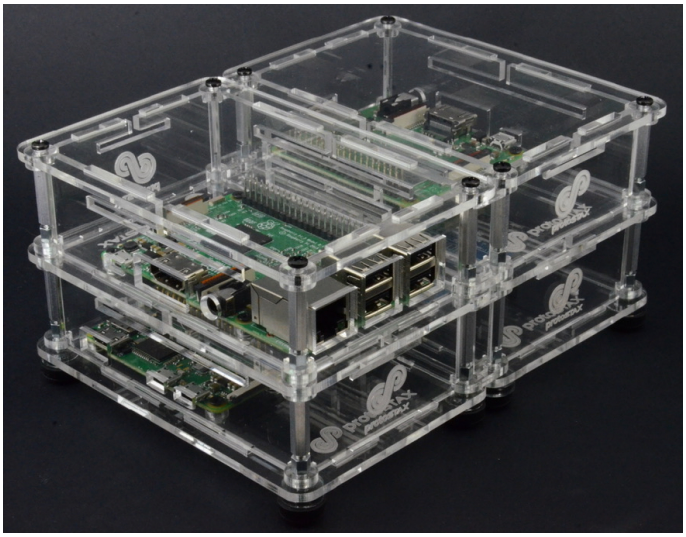
You can also vertically stack your ProtoStax enclosures! Vertical stacking is useful in a variety of scenarios. For example, if you have a Raspberry Pi cluster, you can stack them vertically like a tower.

Vertical Stacking is also useful in the case where you have any buttons on knobs or displays to interact with the user. You can have your Arduino on the bottom in Closed Configuration, and a Breadboard on the top in Platform Configuration.

Vertical stacking is thus useful when the boards don't need to be collocated side-by-side, when you want vertical stackability for space constraints, or for displaying the top layer in Platform Configuration with open access, where the bottom layer could be more protected and enclosed.

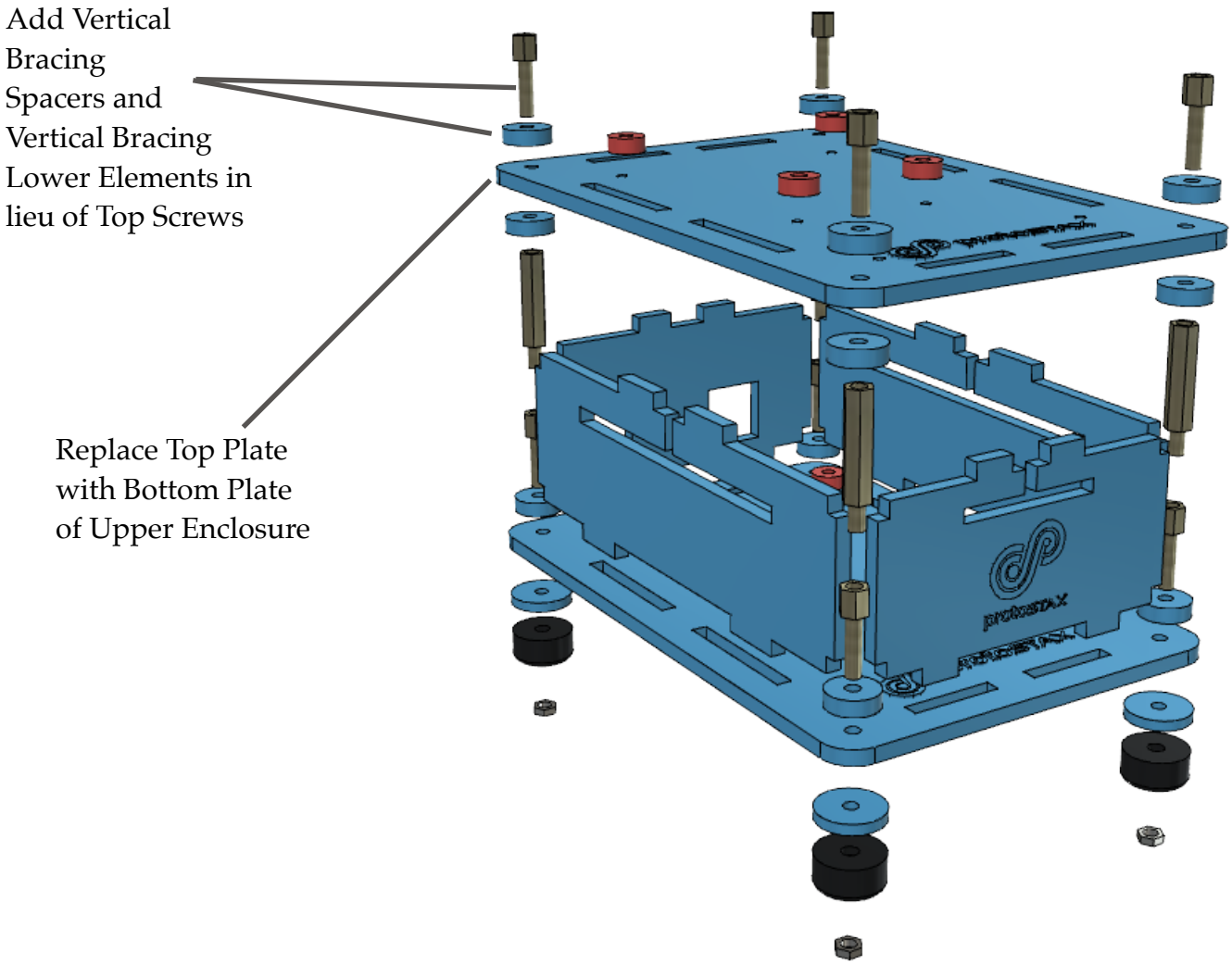




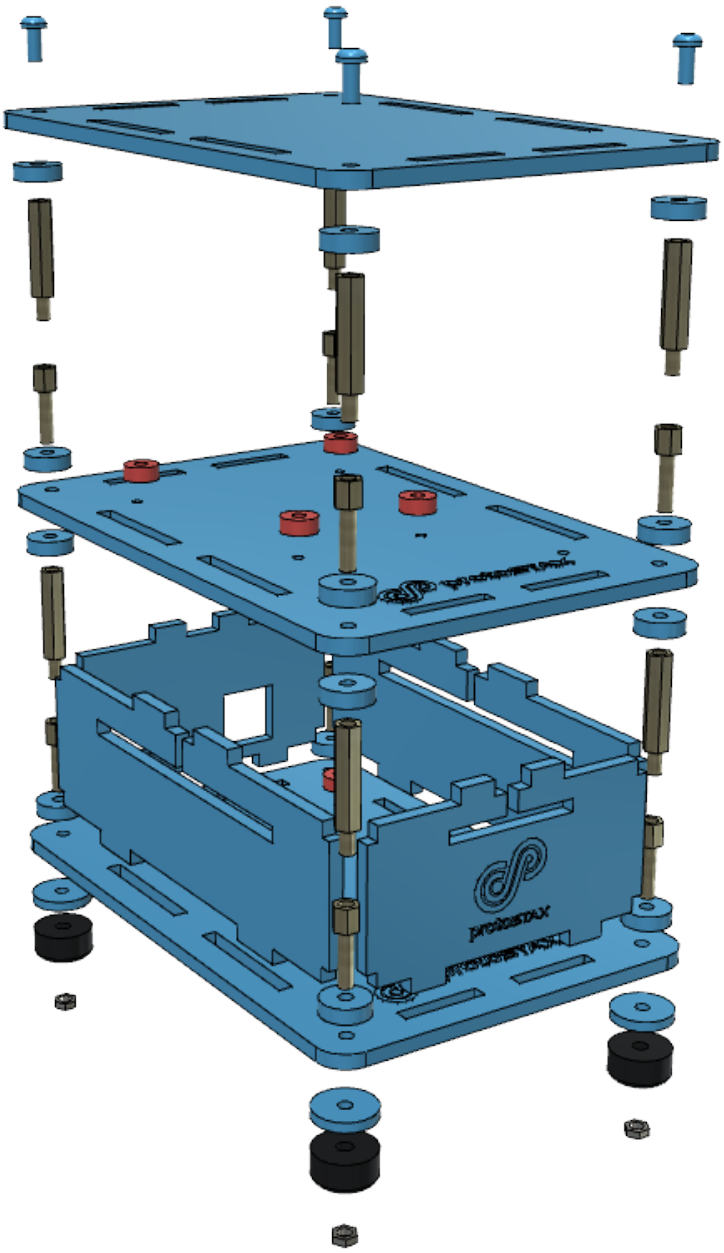


Or combine Horizontal and Vertical stacking.

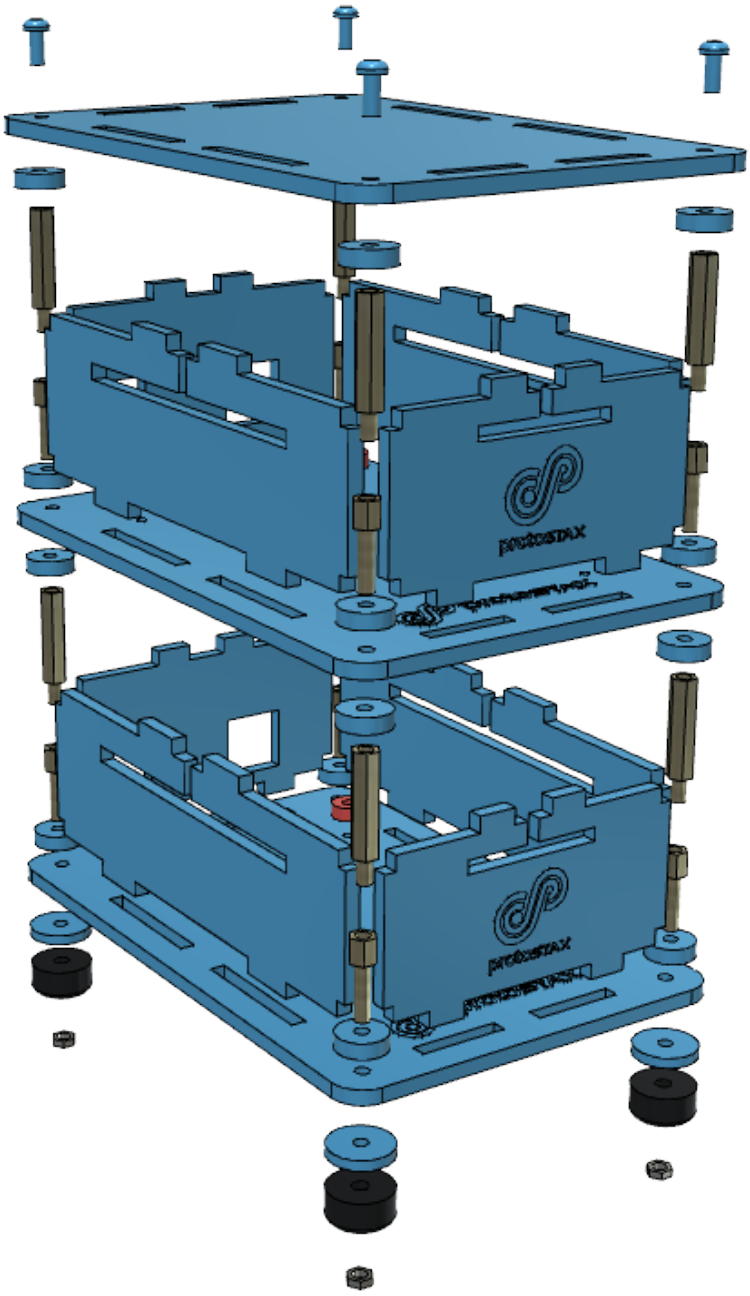
Vertical Stacking doesn't need any extra components, unlike Horizontal Stacking (which needs the Horizontal Stacking Kit). To vertically stack, you just replace the Top Plate of your enclosure with the Base Plate of the enclosure you want to stack on top. You remove the Top Screws, and instead replace them with Vertical Bracing Spacers and Vertical Bracking Lower Elements for the upper enclosure - this results in a Platform Configuration for your upper enclosure. The rest of the upper enclosure assembly (for Open Configuration or Closed Configuration) follows the steps as previously outlined.



Add the rest of the elements for the upper enclosure to get it into Open Configuration. Similar to the steps for Open Configuration for a single enclosure.



Add the rest of the elements for the upper enclosure to get it into Closed Configuration. Similar to the steps for Closed Configuration for a single enclosure.



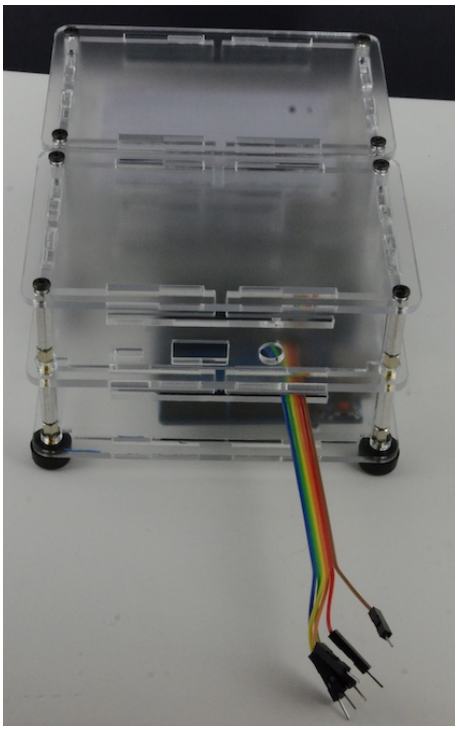
6. Cable Management

It is essential in prototyping to be able to interface/connect with external systems. Even with an infinitely stackable and modular system like ProtoStax, you might still have external boards, etc that you would like to connect to. You will also want to be able to manage cables going between different ProtoStax sub-enclosures that form part of a bigger whole enclosure.

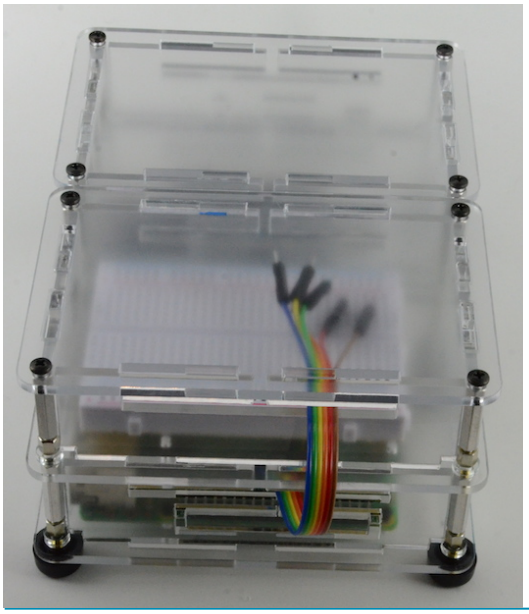
ProtoStax enclosures include cable management features that help you in these cases. Most side walls also include cable management cutouts. The Wall Slots on the Base Plate and Top Plate can also be used to organize and manage your cables when you are using your enclosure in the Open Configuration.

Let us look at some of these examples:

Cable Management cutouts in the side walls allow you to do cabling between your ProtoStax protected prototype and external systems.

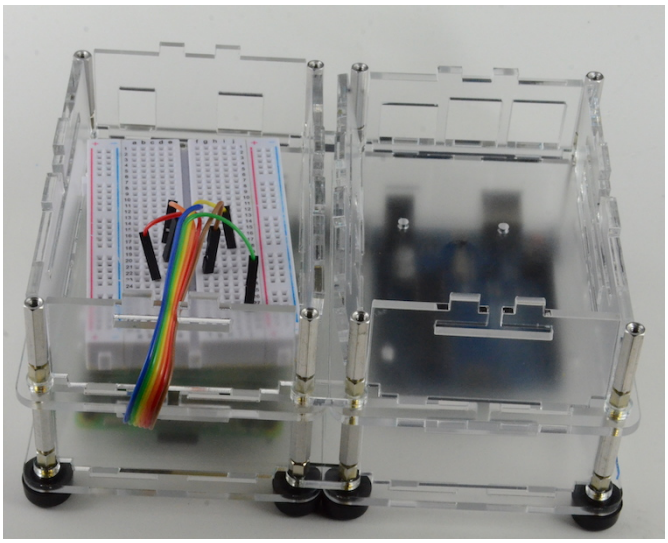


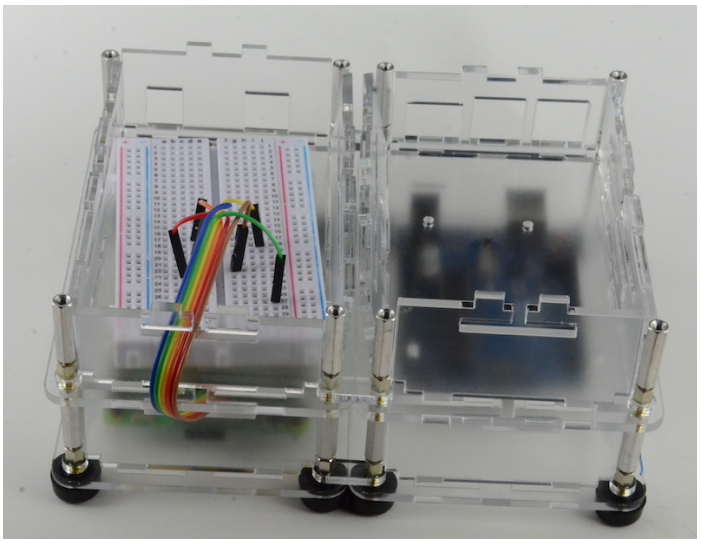
Cable Management cutouts can also enable you to do wiring between different levels of your vertically stacked enclosures as shown below:



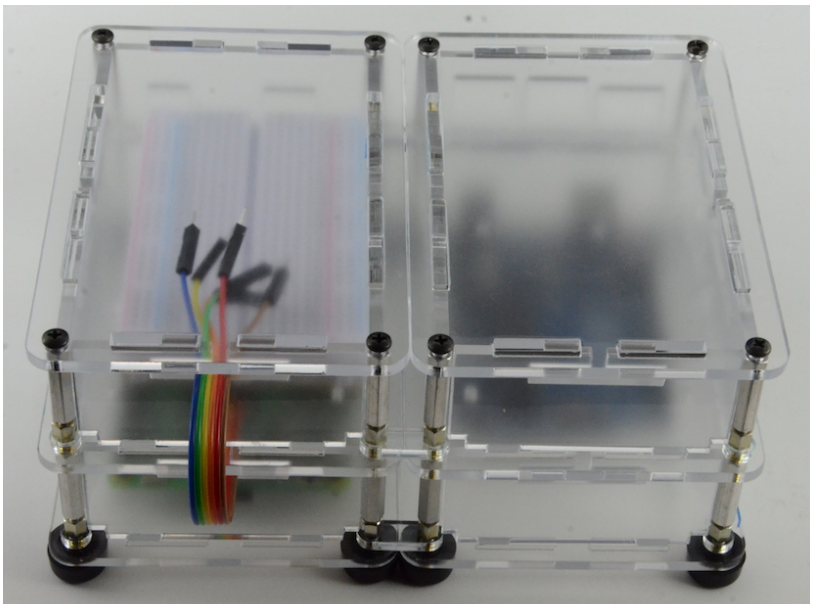
The cable management cutouts can also be used internally between horizontally stacked enclosures that have the inner side walls in place, to do the wiring between sub-enclosures.

The following images show how the cable management cutout in the side wall facilitates cable insertion. Because of the hole at the top, you can slip in the cable from the top opening near the tabs and ease it into the cable management slot. You can then place the Top Plate after that and close up the enclosure.

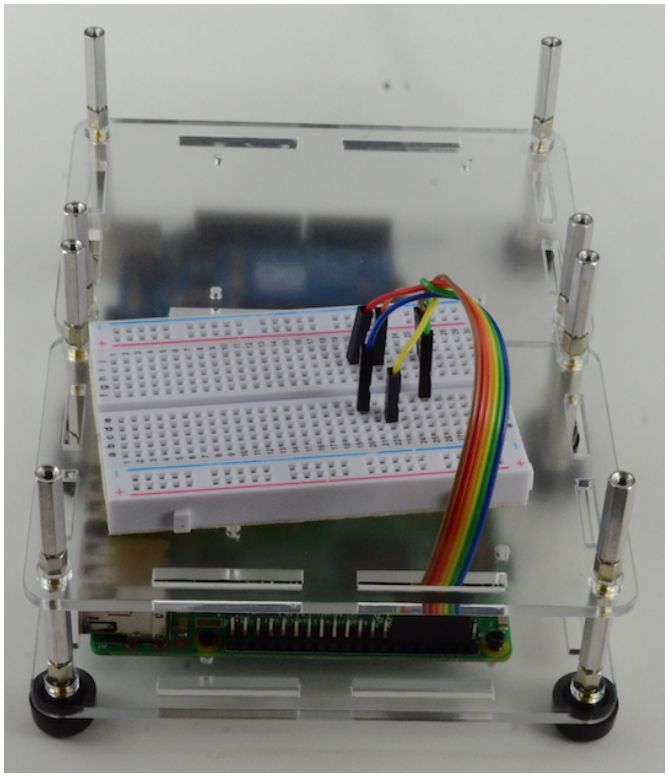




[Note: Because of the hole at the top by the tabs, the upper tabs of the Side Walls become cantilever members. Care should be taken not to bend the cantilevers laterally (i.e. horizontally) as doing so would exert excessive force on the acrylic material and cause it to snap. Once the Top Plate is in place, it protects the cantilevered tabs from lateral movement - exert care when placing the Top Plate and aligning it with the Side Wall tabs not to move the cantilevered tabs laterally]



If you are using the enclosures in Open Configuration, you can also use the Wall Slots on the Bottom and Top Plates for cable management. They will help keep cables neat and organized between different levels of the enclosure system. Here is an example below!



7. End

We hope that this User Manual has been useful to you in understanding the different configurations and capabilities of the ProtoStax Enclosure Systems. Of course, the configurations described herein are suggestions and not exhaustive. We look forward to hearing about your own configurations and usage of ProtoStax Enclosures!

Please feel free to write us with any comments, questions, suggestions or concerns you may have! We love hearing from you!

If you can take a moment to go to our website and rate/review the enclosures, that would be awesome!