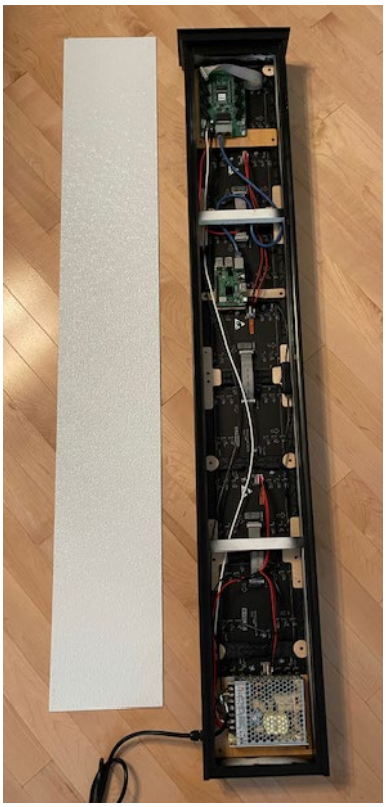
Tony’s P5 Pixel Poles

-v1 2021-

Introduction:

These are based on the shorter panels in Doug's Inspire Light Shows display using P5 panels and slightly different electronics due to what was available when I started the project. The design approach could easily be scaled to accommodate taller panels and likely larger matrix panels with the addition of a little more internal bracing. This version contains the panel controller, Pi with FPP and power supply all within a single enclosure that only requires WiFi and power when setting up and still remaining fairly thin and compact at a little under 3" deep.



A friendly warning: I started out planning to build 2 which quickly became 6 and then 8 panels for my holiday display so they do have a way of multiplying once you get started with them.

Getting Started:

These displays are essentially just a 1x4 P5 panel matrix, oriented vertically instead of horizontally. There are a number of options for the electronics so feel free to use whatever you are comfortable with or are used to using. Other options include things like the PocketScroller from Kulp lights, various Pi hats, and others. In my case, I went with a Colorlight panel controller and a Raspberry Pi 3b+ as these were readily available. This is probably a little bit of overkill for a smaller matrix but the performance has been outstanding in testing so far and the components could be used to manage much larger layouts in the future.

Main Components Used:

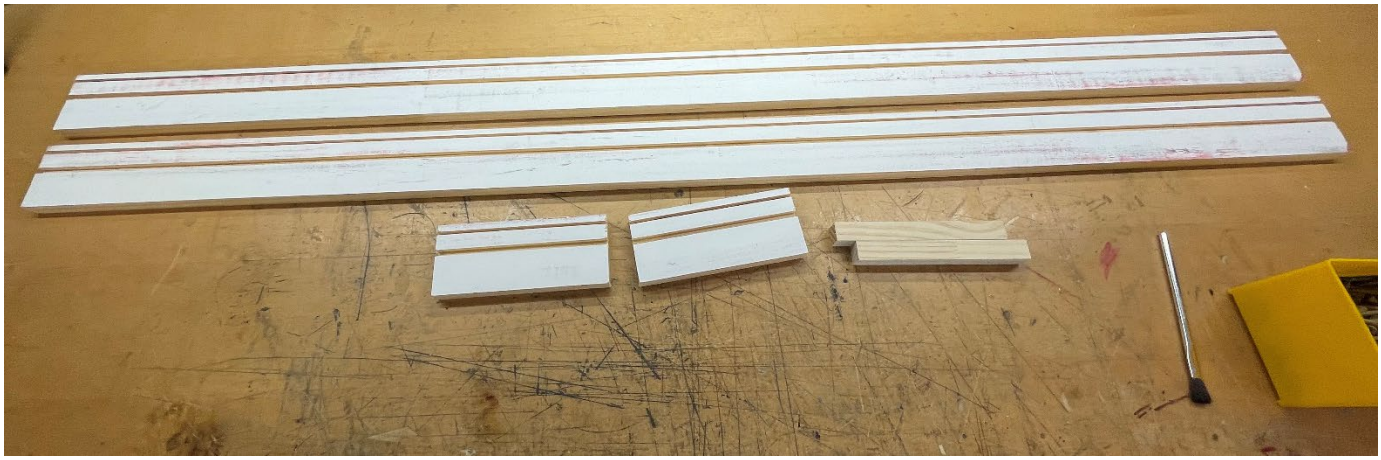
- A Raspberry Pi 3b+ with SD card for FPP
- Gigabit Ethernet for connection to the Colorlight
- WiFi for show network connectivity
- A Colorlight 5A-75B Panel Controller with power and data cables
- 4ea - P5 panels
- Meanwell LRS 100-5 power supply
- Short (1-2') CAT5E or better cable

The Basic Enclosure:

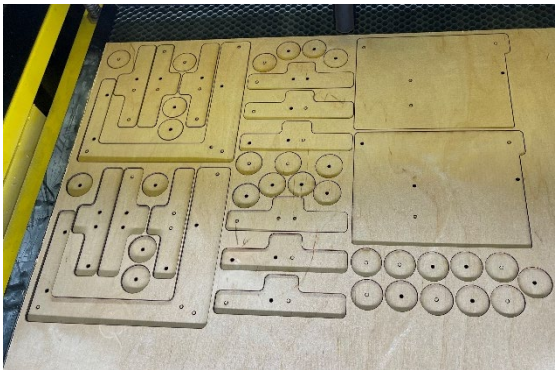
The top, bottom and sides can be made from any straight 1x4 boards. These were made using pre-primed boards from the home center as these were the straightest thing I could find at the time. The boards were then ripped down to 2 5/8” wide with a 1/8” wide dado at ¼” from the front edge for the clear polycarbonate front panels and a ¼” wide dado at about 15/16” from the front edge for the panel support and mounting brackets which hold the P5 panels together and lock them into the frame. The dados are both slightly over 3/8” deep.

For this design, all the sides of the enclosure are the same profile to minimize the number of setups, especially when making several panels. As a reference, for my panels, the sides were cut to 52” long with the top and bottom pieces being 6 5/16 long for attaching between the sides.

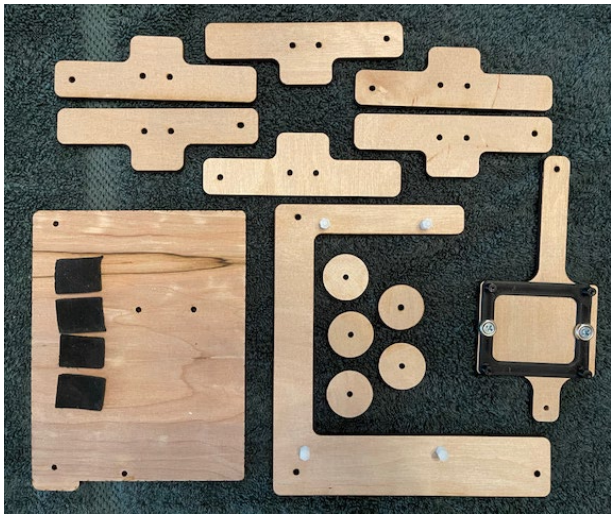
Sample enclosure side profile



One complete set for an enclosure



To mount the panels, I used a set of laser-cut mounting brackets made from 5mm (~1/4") underlayment plywood. These are designed to align and fasten the panels together while also locking into the second dado to hold the panel assembly in place inside the enclosure. I also cut a number of small round pieces which are attached to the unused holes in the panels and further capture the panel assembly into the dado to hold it all in place.

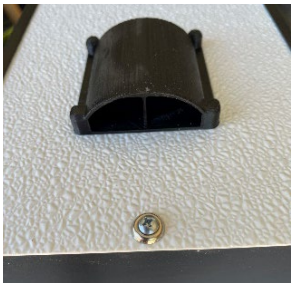


I designed the brackets so that they could also be used to mount the power supply, Colorlight and Raspberry Pi components. With all the panels assembled, the enclosure was sized to fit the width as closely as possible but to leave approximately a 3/32" total gap at the top and bottom of the panel assembly. This gap allows the assembled panel to have a small gap at the top and bottom in case any moisture did make it inside the enclosure. I used the 4 small foam pieces to hold the panel assembly centered vertically, leaving most of the area open in case any moisture was able to make it into the cabinets. Since the dados are continuous along the length of the panels and were left open at the bottom, any moisture that might make it past the polycarbonate fronts should hopefully be able to drain out the bottom of the enclosure.

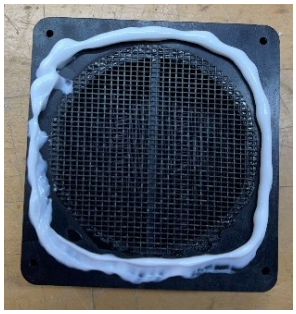
For the glue-up, I assembled the panels around the polycarbonate front panels which I ordered from Ken at Wired Watts CNC cut exactly to size. This was super convenient and cost-effective compared to trying to source it locally. In my case, the front panels were 1/8” thick polycarbonate sheet, 7” wide x 51 1/8” to match the dimensions of my enclosures. The top and sides were glued and screwed together using the polycarbonate sheet (with the protective skin still installed) to help align everything. I only attached the bottom of the enclosure with screws so it could be removed to allow the polycarbonate to be taken out for painting. I also used some scrap wood from the panel sides to brace the enclosure in 2 places along the back. These add quite a bit to the rigidity of the assembled box and should help to reduce the chance of warping in the future.

Once the enclosure was glued up, I installed the vinyl molding that will hold the back panel in place. This can be held on using exterior caulk and a few T50 staples along its length using a pneumatic stapler. The staples were placed in the portion of the molding that is later covered by the FRP panels.

The back of the enclosures is made from fiberglass reinforced panels (FRP) and mounted using the vinyl molding sold for installing these as bathroom wall panels. The material is available at most home centers and is thin and waterproof. With the trim molding, it is also easy to install and can be easily slid out as needed to access the components while still providing a moisture resistant cover. This trim is left open at the bottom to allow any moisture to run down the molding to the open end at the bottom and drain away. The same is true for the dados for the front panel which also have areas that should allow any moisture to drain. I also chose to mount these using a stand that keeps them from sitting directly on the ground when installed.



I designed and 3D printed air vents which are installed in the back panel at the top and bottom to allow cooler air to enter at the bottom and warm air come out at the top. Since I wanted the back panel to easily slide out when necessary, I needed a vent that was flush on the back and wound up designing and printing some for these panels. The vents are attached from the inside of the back panel using countersunk screws and have a small piece of window screen material to help keep things out.



To cover the top of the enclosure and provide some additional weather resistance, there is an additional panel which is sealed to the top. This panel is caulked in place to cover the open dados and has an overhanging "shingle" made from some of the extra FRP which is glued and screwed to the top so that it extends beyond the enclosure on all sides. My hope is that this will provide a drip edge and reduce the chance of water getting into the top of the enclosure and reduce the amount running down the front, sides and back.

Before finishing the enclosures, give some thought to how you plan to mount these panels and install whatever supports are necessary before finishing them. They can be installed using guy wires and a simple foot made using strong-tie straps and landscape stakes, mounted to the house or other structures as hanging panels or attached to a free-standing base.

In my case, I welded some simple feet using a 12” long section of ¾” square tubing, some large washers as feet and tabs to allow these to be mounted to the sides of the enclosures. The hollow feet allow the panels to be installed directly onto vertical rebar stakes which make it easier to deal with the varied slope of my lawn and then reinforced with guy wires to handle windy days.

For finishing, I removed the lexan panel then painted the FRP shingle on the top and the plastic trim with black spray paint. The rest of the enclosure was painted with exterior semigloss black to seal and protect it. I recommend being sure that the black finish extends inside just a little past the dado for the clear front panel. This will help absorb any stray light from the panels that might otherwise reflect off the edges of the enclosure.

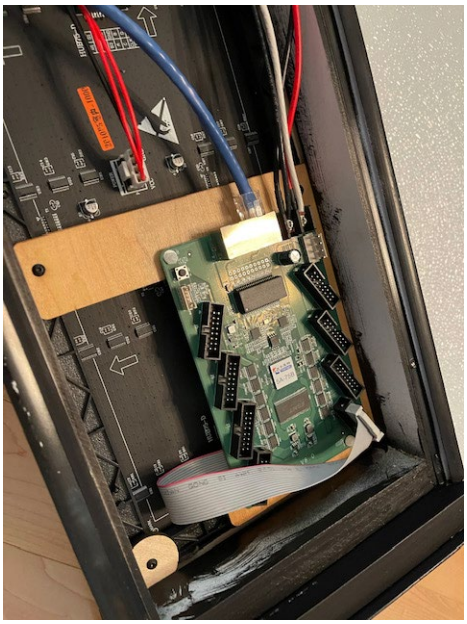
Final Assembly:

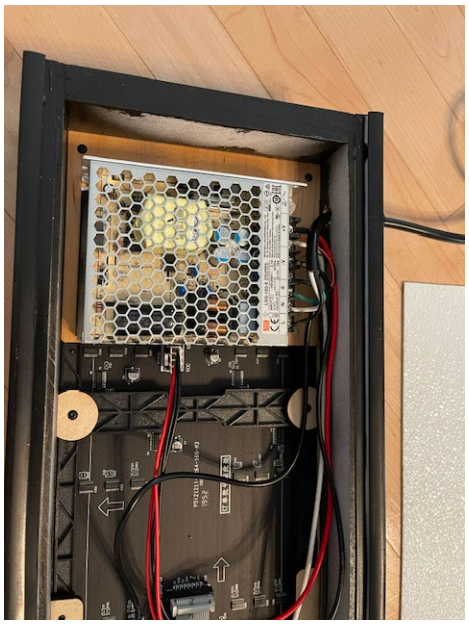
The actual assembly is pretty straightforward. Once the paint has dried, unscrew the bottom piece of the enclosure and scrape off any buildup of paint from the inside of the dados. Remove the protective film from the polycarbonate panel and slide it into the dado until it fully seats into the top board. Reinstall the bottom enclosure piece to lock the clear panel in place.

I used a PG7 cable gland to bring the power cord into the side of the enclosure. Since the wooden sides are thicker than the threaded portion of the cable gland, I "tapped" the hole in the wood using a regular metric tap then threaded the gland directly into the side panel using a little 5-minute epoxy for strength and to provide a good seal. Be careful not to overtighten it since the wooden threads are easy to strip and are only really used to pull the cable gland into place and hold it until the epoxy has set. Once cured, this should be permanent and hopefully provide a decent seal for the one cable entry point required.

To assemble the panels, carefully remove any sawdust from the enclosure and clean the inside of the clear front panel if necessary. Lay the P5 panels in the enclosure directly on clear front panel. This is also the best time to install the foam spacers at the corners of the top and bottom panels while everything is still loose. Pay attention to the direction of the orientation arrows printed on each panel to keep these all going in the same direction. In my case, this was pointing towards the bottom of the panel assembly. Go ahead and attach a short ribbon cable to the top panel since this will be covered by the bracket holding the Colorlight board when this is installed.

Attach the components to their mounting brackets then slide these into the dado in the side of the enclosure. In my case, I found that M3x8 machine screws worked for mounting the power supply and I used M3 nylon nuts and bolts to mount the Colorlight board. The Pi was mounted using some M2 machine screws to a simple 3D-printed bracket. The bracket was attached to the mounting panel using short wood screws that were sanded flush with the back of the plywood bracket once installed to avoid any chance of them contacting the P5 panel underneath.





The plywood panel brackets are then attached to the P5 display panels using the rest of the brackets and M3x10mm button head machine screws. I found that it worked well to pull the panels together with one hand as I tightened these screws to minimize the chance of gaps between the panels. As these screws are tightened, they will lift the display panels away from the clear front, leaving a 1/16” – 1/8” gap to allow airflow and reduce the chance of moisture build-up in front of the panels. Avoid overtightening these screws, they only need to be snug to hold the panels in place. The circular brackets help to provide additional support for the panel assembly.

To wire the panels, connect the ribbon cables between the displays and the top panel input to output J1 on the Colorlight board (or the appropriate wiring of these connections for your choice of panel controller). Use a short Ethernet cable between the Raspberry Pi 3b+ Gigabit Ethernet connection and the Colorlight board input.

Connect the power leads to the panels and wire these to the power supply. In my case, I was able to run the lower 2 panels directly to the power supply connections, a pair of power leads from the power supply to the Colorlight board where I also connected the power lead for the upper 2 panels. I used an old USB charging cable to power the Pi from the power supply.

All that is left is to configure the Colorlight board, install FPP on the Pi and configure it to drive the panel and start sequencing for it. The easiest approach I found was to treat the panel as a standard horizontal display in the Colorlight and FPP configurations then use Xlights to configure it as a vertical matrix. The starting point of the matrix and rotation can be used to get the xLights and actual display orientations to match.

Once things are configured and tested, install the back panels. These just slide in from the bottom of the enclosure all the way till they meet the top piece. They can be secured with a small screw and washers at the bottom. I used a trim washer on the outside and a second small washer as a spacer at the bottom.

Finished Panels:

This is one of the panels, shown when I was testing the stands using 2’ rebar stakes as supports. The eyes at the top are for guy wires to add some rigidity on windy days. I used ¼-20 hardware and T-nuts inside to attach the stands and eye bolts.



I also built one pair with free-standing feet so that they would be easy to set up on any reasonably flat surface. Here is the complete set.

Credits and Thanks:

Thanks again to Doug at Inspire Light Shows for the inspiration and information when I was getting started and to Ken and Wired Watts who were a great source for the custom-cut polycarbonate panels, the P5 displays and controllers and some great help along the way. These displays have already been a lot of fun, providing a quick way to set up simple displays for nearly any holiday and a great variety of textures when part of a larger display arrangement.