
Subject: 4 Pi Build in San Luis Obispo - Flush Mounting and Bracing

Posted by [alexg](#) on Sun, 24 Jan 2021 18:19:49 GMT

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Hello from San Luis Obispo, CA!

After more than a year of pestering Wayne via email and scouring the forum I have started my 4 Pi build. My goal is to share my progress along the way but have a few questions to get started.

1) I want to flush mount the horn/waveguide. Does anyone have any pointers to share? My thought was to make the first cut with a jig saw and some kind of cutting guide and then go back over the opening with a router and rabbet bit. One thing is for sure, I am definitely going to mess this part up once or twice so I had several extra pieces cut so that I can just do it over if necessary.

2) Is wood glue sufficient for securing the bracing on the inside of the enclosure? I am thinking about using wood glue and shorter brad nails, nailed from the exterior of the enclosure. Good idea or not necessary?

Speakers will go in the Great Room (Kitchen/Dining Room/Living Room). Due to the layout and size of this space my plan is to build 3 speakers. Speakers will be set up in an L shaped formation so that I will have 2 listening areas (See diagram below). 2 of the speakers will flank the fireplace for critical listening, home theater (tv is mounted above fireplace), or if I just want to relax on the sofa and listen. For this configuration, speakers will be set up approx 8-10' apart with flanking subs. Listening position will be 8-10 feet away. The third speaker will be used in conjunction with the speaker to the right of the fireplace. Third speaker will be positioned approx 20' from the other speaker. Together this configuration will be used for daily listening and background music while we are in the kitchen and/or sitting at the island where we spend most of our time while in this space. I will use a toggle switch to toggle back and forth between the configurations. As far as my diagram goes, I am not an artist and definitely not an engineer.

Room Diagram

To build 3 speakers I used 2 full sheets of MDF. This gives me all of the pieces I will need with enough material left over for extra "parts," primarily the baffles. As I mentioned above, in case I mess something up I can just start over. I do own a table saw (portable, contractor grade) but in order to ensure accuracy and consistency I had the local lumber yard cut the pieces for me. I am not talking about Home Depot! The local lumber yard has been around for decades. In addition to supplying lumber and hardware, they specialize in hardwoods, trim, and molding. They have an old school professional grade table saw that is dead accurate and offer a cutting service. For \$20 they made my cuts using a cut sheet that I provided. For anyone planning to go the DIY route and not use Wayne's Kit (which is a great value and would have made my life infinitely easier) I highly recommend this approach if you do not have a cabinet style table saw.

A few construction pics.

File Attachments

- 1) [4 Pi - Room Diagram.jpg](#), downloaded 854 times
 - 2) [4 Pi - Gluing up enclosures.jpg](#), downloaded 811 times
 - 3) [4 Pi - 2 Enclosures.jpg](#), downloaded 847 times
 - 4) [4 Pi - Ports.jpg](#), downloaded 855 times
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Subject: Re: 4 Pi Build in San Luis Obispo - Flush Mounting and Bracing

Posted by [Wayne Parham](#) on Sun, 24 Jan 2021 21:31:48 GMT

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Looks like you're off to a really great start!

The braces can be installed with white glue only - no screws or tacking nails necessary. Make the braces a tiny bit long - like about a 32nd of an inch - so they fit snug. This preloads the panels being braced, which is what we want. Just put some white glue on each end of the braces and press 'em in.

I'll defer to the cabinetmakers to tell you how to route the baffle for the waveguides. I think they use a follower of some sort that indexes off the through-hole, but I'm not sure. I know that when it's done on a CNC machine, no sort of follower is necessary - the dimension is programmed in. But I do think you can do it by hand with a follower.

Subject: Re: 4 Pi Build in San Luis Obispo - Parts Arrived, Got a Router Jig

Posted by [alexg](#) on Thu, 25 Mar 2021 17:12:01 GMT

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It has been a few weeks since my original post. Somehow, when I do projects, audio and otherwise I seem to forget just how difficult it is to find time to work on stuff. In the planning phase I envision myself working away, continuously until the project is complete. Or, actually getting an entire Saturday to myself to focus on a project and make significant progress. Fat chance! The reality is that my projects are filled with late night and early morning sessions spread over several months. And of course, just when I find an opening to hunker down and get stuff done one of my kids will start crying or call out for a "milky" or get up ridiculously early on the very same day that I decide to get up early and want to be read to.

Anyway, Wayne, thanks responding to my last post.

The parts arrived at the end of February. Everything was in good order and well packed. Crossovers are top notch. Good quality boards, nice lay-out, and clean solder joints. I went with

standard capacitors and resistors but opted to upgrade the inductors to the 15awg version. As far as upgrades go, Wayne has an article in the FAQ section of the forum called "Upgrades." As the title suggests, it talks about the available upgrades and their benefits including which make the greatest impact. It sounds like upgrading the inductors delivers the most noticeable improvement as far as the crossovers components go. For the drivers I will be using the B&C DEC250 for the compression driver and the JBL 2226H for the woofer. Based on what I have read on the various forums, available product reviews, and on this forum, the driver upgrades are a "no brainer."

I mentioned previously that my goal is to recess the drivers and horns but that I wasn't sure how to go about handling the horns. For the JBL 2226H I will use my Jasper circle jig. For the horns, my neighbor had a really great solution for me. As it turns out, he is slightly more than obsessed with extruded aluminum framing. His entire garage, shop, and work van are filled with furniture and components made from extruded aluminum not to mention the entertainment center in his living room and the desk, printer stand, and bookshelves in his home office. He lent me a router jig that he made using the same.

The jig is comprised of 4 lengths of 2060 extruded v-slot aluminum framing and a handful of the L-brackets that are designed to work with this material. At the end of the day you get a jig that is adjustable but sturdy.

I made a couple of practice runs and the jig works great. I do need to figure out how to handle the corners because the finished radius that you get with this jig is slightly smaller/tighter than the radius of the corners on the horn. Unless someone has a suggestion I may just use some kind of wood filler to fill in the difference and sand it down. My plan is to use veneer so I should be able to cover it up nicely. There is a product that my cabinet guy introduced me to a few years back that is similar to Bondo. I have used it on several occasions but can't quite remember the name. It comes in a black can with bright orange writing and is available at Home Depot, Lowes, etc.... I will include the name in my next post.

Got a couple of questions.

1) Is there any additional benefit to adding dampening to the horns? Based on what I could find in the forum, there is not and the "care guide" that comes with the horns states that the abs material provides excellent dampening. However, I do see that some people do it anyway and swear by it.

2) For the flanking subs I am will be using 2, 15" Dayton Drivers from Parts Express and 2 of the Denovo 3.0 Cubic/Ft Sub enclosures. I plan to port the enclosures. My question is, as far as flanking subs go, if the driver is facing forward and I do not have room for a port in front, is it better to position the ports in the back or have them firing down to the floor? If the back is the way to go is it better to mount them high or low? Since I am adding the ports myself, I can add them

wherever is best.

3) I am thinking to finish the speakers in a Walnut veneer. Does anyone have recommendations for wood veneer? Brands that have worked well? Where to buy? Retailers and/or brands to avoid? Your input would be much appreciated.

4) What size screws would you recommend for the JBL Drivers?

Thanks in advance!

File Attachments

- 1) [4Pi Parts.jpg](#), downloaded 618 times
 - 2) [Extrude.jpg](#), downloaded 610 times
 - 3) [Router Jig.jpg](#), downloaded 675 times
 - 4) [bracing.jpg](#), downloaded 645 times
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Subject: Re: 4 Pi Build in San Luis Obispo - Parts Arrived, Got a Router Jig
Posted by [Wayne Parham](#) on Thu, 25 Mar 2021 21:25:29 GMT

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Nice work so far. And man, I hear you about the "things get in the way" issue when doing projects. I always have several projects underway, and like you, I have several disruptors. But I always try to remember that a mountain is climbed one step at a time and that it pays off to sometimes take detours and rest breaks. I sometimes have to tell myself this because my nature is to get stressed and try to conquer the mountain in one day. Never any good in that. So I know to always enjoy the disruptors rather than to endure the disruptors. In fact, even my terminology is wrong, in that I should change from calling them "disruptors" to maybe "detours" or even think of them as "fun distractions."

Anyway, I digress.

To answer your questions:

1. Horn damping. It doesn't hurt, that's for sure. Some people swear by it. I personally don't find it useful because the H290C is so thick and heavy. It's well-damped, as dead as a rock. Its bell mode is over an octave below the passband, at around 420Hz. So the sound passing through it cannot energize it and the sound on the outside of the horn is damped by the insulation within the cabinet. Still, you won't hurt anything by adding rope calk or any other sort of damping goo on the outside.

H290C (unmounted) Bell Mode

2. Port location for flanking subs is unimportant because the sound emanating from the port is

almost purely the Helmholtz region, certainly very little up high. I do think it's useful to have the woofer cone forward-facing, since the lower-mids emanate from there.

3. Sorry that I'm not as much help here as the woodworkers. Usually the cabinetmakers I've worked with show me samples that I choose from. But I do know you can buy online and many of the online sellers will also show grain images.

I've shopped at "Woodcraft Supply" - which is both online and has "brick and mortar" stores - and found excellent veneers there. They also have nice "chunks" of wood which were great when I was making CNC wood horn/waveguides. The link below shows some of the veneer products they have available online and/or in the stores.

Woodcraft Veneers

4. I like to use 10/32 thread button head screws with black oxide coating. They're attractive and fit nicely. Use T-Nuts or threaded inserts. The length depends on whether you surface-mount or flush-mount, because the depth of the baffle and any additional backing you might provide for strength behind a router groove sets the length needed. But I tend to find that 1-1/4" seems to always work.

Subject: Re: 4 Pi Build in San Luis Obispo - Parts Arrived, Got a Router Jig
Posted by [alexg](#) on Fri, 26 Mar 2021 18:47:38 GMT

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Wayne,

Thanks for the quick response. I am glad that I am not the only person that struggles to get stuff done.

For the subs, if I position ports on the bottom of the subs (facing down to the floor) is there a minimum distance that I should maintain between the bottom of the subs and the floor?

As far as dampening the horn, you had me at "I personally don't find it useful." ha! ha! If the designer doesn't think it is necessary then that is all that I need to know.

Subject: Re: 4 Pi Build in San Luis Obispo - Parts Arrived, Got a Router Jig
Posted by [Wayne Parham](#) on Fri, 26 Mar 2021 19:17:01 GMT

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I've often used a rule-of-thumb to make the minimum spacing between a port and a nearby boundary to be equal to the port diameter.

But I've also found many times where this wasn't needed.

The Helmholtz resonance isn't affected much by having boundaries nearby, and that's what matters most. Beyond that, you have a whole different matter - Turbulence that causes audible chuffing. This doesn't change port tuning, but it does create audible artifacts. And that's what's really an issue when we're talking about the distance to a boundary. It's an issue of airspeed and the potential for turbulence.

So basically, if you don't hear something off, you're good. It'll keep the dust from collecting under the port, that's for sure. :lol:

Subject: Re: 4 Pi Build in San Luis Obispo - Parts Arrived, Got a Router Jig
Posted by [OutOfSpace](#) on Sat, 27 Mar 2021 15:30:45 GMT

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Alex,

re; the radius for your horn cut-outs, are you using a guide bushing on your router or just running the base within the jig? I guess in either case, if you use a bigger pattern bit the corners will have a bigger radius, hopefully matching the horn.

No surprise there. Nice jig, too!

Chris

Subject: Re: 4 Pi Build in San Luis Obispo - Parts Arrived, Got a Router Jig
Posted by [alexg](#) on Sat, 27 Mar 2021 16:23:08 GMT

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Hi Chris,

I am using a Template Router Bit with a flush trim bearing. The bit is 3/4" wide x 1/4" deep. In my practice runs I was sinking the bit and running the bearing along the inside of the jig. I will look into bushing guides. Thanks for your input.

Alex

Subject: Re: 4 Pi Build in San Luis Obispo - Flush Mounting and Bracing
Posted by [Jensen](#) on Mon, 05 Apr 2021 11:56:21 GMT

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<https://www.veneersupplies.com/>

I've used these guys a few times, including for my 4pi project (my first foray into veneering). Great lot consistency and a wide selection so you can spend as much or as little as you want. You can probably search under my name to find my 4pi project. Be warned, veneering such large sides isn't a trivial task...

Good luck and enjoy the process.

Subject: Re: 4 Pi Build in San Luis Obispo - Settings for Flanking Subs

Posted by [alexg](#) on Tue, 20 Jul 2021 02:36:49 GMT

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Finally, finished my flanking subs. I am using 2, 15" Drivers from Parts Express in ported enclosures.

For flanking subs, you said "just set it for low-pass 100Hz BW 12dB/Oct." For this I am going to use a miniDSP that I have from a previous project (LXmini from Siegfried Linkwitz). It will be super easy to set the recommended low pass filter in the DSP. Should I set a high pass filter as well?

File Attachments

1) [Sub 11.jpg](#), downloaded 270 times

2) [Sub 6.jpg](#), downloaded 261 times

Subject: Re: 4 Pi Build in San Luis Obispo - Settings for Flanking Subs

Posted by [Wayne Parham](#) on Tue, 20 Jul 2021 15:52:09 GMT

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It never hurts to use a high-pass filter for vented subs set at or just below the Helmholtz frequency. So if your sub cabinets are tuned to 20Hz, set a fourth-order high-pass at 15-20Hz.
