
Subject: My 4 Pi Build

Posted by [Unity_Coupled](#) on Thu, 14 Sep 2023 02:20:30 GMT

[View Forum Message](#) <> [Reply to Message](#)

I've been itching to take on another high end audio project for a while, and became interested in Wayne's work, and the 4 Pi in particular after lurking around here for the past several years. Of course I don't need any more speakers, or projects for that matter...the farm keeps me busy enough as it is! But I thought this would be a fun departure from the usual rigamarole.

Wayne kindly provided the plans for the 4 Pi and I ordered the waveguides and crossover PCB's from him. I also took advantage of a few Labor Day sales and bought all the components I needed. I opted for a high end build with 2226HPLs and a pair of Denovo DNA-360's I had, which feature nearly identical performance and characteristics to the DE-250. The crossovers will use Auricaps for the high pass circuit and Z-caps for the low pass, and 15ga inductors all around. Resistors are the standard Dayton ceramic types, as I'm not convinced that resistors have a significant impact on the sound. I may still swap them to the Mills later on.

The plan will be to style the speakers similarly to Jensen's build here, with a couple changes: <https://audioundtable.com/forum/index.php?t=msg&goto=91675&> I will be flush-mounting the drivers, and mine will have removable grill cloth inserts that come flush with the edges of the cabinets. I'm hoping to find some textured fabric that's akin to what Klipsch used on many of their heritage products to complete the look.

Well, enough blabber. Let's get to it!

First order of business is to build the crossovers. I started by fastening both PCBs together and drilling holes in the appropriate spots. I used a 1/16" drill for the resistors and the Z-caps, and 5/64" for everything else.

Components being glued to the board. I tightly kinked the leads underneath so they stay put.

First round of soldering...

Parts Express did not have the 15ga. Jantzen inductors in 0.5mH, so I ordered them in 0.55mH and unwound them from the inside until I achieved the desired value.

Close enough!

More components being adhered to the board. Audience recommends connecting the outside foil towards the input side of the high pass circuit, and the other side towards the tweeter input. I'm

skeptical that it makes a difference but I did it anyway.

This is where I stopped for the day, as I had other duties to attend to.

File Attachments

- 1) [PXL_20230913_175912228~2.jpg](#), downloaded 454 times
 - 2) [PXL_20230913_223820870.jpg](#), downloaded 459 times
 - 3) [PXL_20230913_225002239.jpg](#), downloaded 445 times
 - 4) [PXL_20230913_230920074.jpg](#), downloaded 446 times
 - 5) [PXL_20230913_232232287.jpg](#), downloaded 436 times
 - 6) [PXL_20230914_003021636.jpg](#), downloaded 450 times
 - 7) [PXL_20230914_005446931.jpg](#), downloaded 449 times
 - 8) [PXL_20230914_011506011.jpg](#), downloaded 433 times
-

Subject: Re: My 4 Pi Build

Posted by [compaddict](#) on Thu, 14 Sep 2023 02:47:05 GMT

[View Forum Message](#) <> [Reply to Message](#)

Nice!

Subject: Re: My 4 Pi Build

Posted by [Wayne Parham](#) on Thu, 14 Sep 2023 13:29:56 GMT

[View Forum Message](#) <> [Reply to Message](#)

Let the fun begin!

Subject: Re: My 4 Pi Build

Posted by [Unity_Coupled](#) on Sun, 17 Sep 2023 05:21:21 GMT

[View Forum Message](#) <> [Reply to Message](#)

It might be a little early in the project, but I've been mulling over finishing options while I wait for the silicone to cure on the crossovers. I always liked the mid-century modern aesthetic of vintage Dynaco and A.R. speakers with light-colored grilles, and I'd like to try and emulate that in the Pis.

The cabinets will be constructed with MDF...I'm thinking I'll veneer them in quarter-sawn American Walnut, which will then be oiled and rubbed into a satin finish. Baffles will be doubled and painted black.

Grille cloth will be stretched over frames that will attach to the fronts of the cabinets with velcro.

I've found a couple fabrics that I think would look the part.

Here's one:

<https://www.midwestspeakerrepair.com/shop/speaker-cloth-foam/grille-cloth/designer-architect-cloth/gc-144-off-white-speaker-fabric/>

Here's another ("swan" color): <https://shop.guilfordofmaine.com/acoustic-fabric/intermix/>

mount to the grille fronts.

Here's a render depicting how I hope these will end up looking...

File Attachments

1) [finishrender.jpg](#), downloaded 388 times

Subject: Re: My 4 Pi Build

Posted by [Wayne Parham](#) on Sun, 17 Sep 2023 14:18:27 GMT

[View Forum Message](#) <> [Reply to Message](#)

That looks really sweet! I love it!

Sometimes, when repairing an old tube radio, the grille cloth will be discolored or ripped and needs replacement. When I encounter one of those, I usually get a replacement cloth at Antique Electronic Supply. Old radios usually have a patterned cloth, but sometimes have a solid color like what you're looking for. So AES might be a good source for you too.

Subject: Re: My 4 Pi Build

Posted by [Unity_Coupled](#) on Sun, 17 Sep 2023 19:11:53 GMT

[View Forum Message](#) <> [Reply to Message](#)

Thanks, Wayne. AES has been my go-to supplier for parts whenever I work on tube gear, although Tube Depot has had better prices on F&T caps lately. I just placed an order for a Sansui SM-80 I'm working on...the chassis is chock-full with old PIO caps! Not the good (sealed) kind that last, unfortunately, as most are leaking out. I looked through their selection of speaker fabric but nothing resonated with me.

Subject: Re: My 4 Pi Build

Posted by [Rusty](#) on Tue, 19 Sep 2023 11:58:29 GMT

[View Forum Message](#) <> [Reply to Message](#)

I like your light white grill cloth contrasting with the dark walnut like finish. That is a classic style that never goes out of it. Rich walnut veneer done well is beautiful I think. You can DO it!

Subject: Re: My 4 Pi Build

Posted by [Unity_Coupled](#) on Tue, 19 Sep 2023 14:07:18 GMT

[View Forum Message](#) <> [Reply to Message](#)

Thanks, Rusty. I've never veneered anything in my life, but I'm fortunate to have a brother who is a cabinetmaker and could guide me through it.

I got tired of waiting for the silicone to cure, so I tossed the crossover boards in my food dehydrator and left them for 24 hours at around 115F. This proved to be rather effective, and after letting the assemblies return to room temperature I finished soldering them up.

Here are the crossovers undergoing burn-in. I shunted across the caps in the zobel circuit so the 100W resistor would act as a dummy load, and added a 8R resistor to the tweeter output.

File Attachments

1) [PXL_20230917_233858626.jpg](#), downloaded 340 times

2) [PXL_20230919_010625221.jpg](#), downloaded 339 times

Subject: Re: My 4 Pi Build

Posted by [Wayne Parham](#) on Tue, 19 Sep 2023 15:00:21 GMT

[View Forum Message](#) <> [Reply to Message](#)

That silicon takes forever to cure, doesn't it?!!

Your dehydrator idea is hysterical, but clever too!

I always let the silicon cure for at least a couple weeks before shipping. But really, I have found it takes months to fully cure. After a few hours, the skin begins to form and within a day or so, it has hardened to the touch but the skin is actually very thin. After a few weeks, the skin has thickened enough to be strong enough for shipping, but even then, if the boards receive a really big impact, the adhesive can fail. When that happens, you can see that the inside has still not cured. I have found it doesn't fully cure - all the way through - for several months.

Subject: Re: My 4 Pi Build

Posted by [Unity_Coupled](#) on Tue, 19 Sep 2023 15:59:21 GMT

[View Forum Message](#) <> [Reply to Message](#)

It's taking a long time indeed. My goal was to reach the point where I could handle them (carefully) and finish the soldering, but there's still some white showing through the globs. I would leave them in the dryer for a whole week if I could, but we have several buckets of fruit from our garden that we need to preserve first. My one comment on the crossover PCBs is I wish the traces were arranged such that zip ties could be installed around the coils for extra security. I'm thinking about mounting the boards on the bottom of the cabs to minimize the stress of gravity.

Subject: Re: My 4 Pi Build

Posted by [Wayne Parham](#) on Tue, 19 Sep 2023 18:21:19 GMT

[View Forum Message](#) <> [Reply to Message](#)

I always mount the crossover board on the bottom of the cabinet too. Certainly always on the three Pi and four Pi models. I make the boards kinda weird, in that I mount the components on the solder side, which then leaves the other side flat. Then I mount the board on a gasket, directly on the cabinet panel rather than using stand-offs.

Subject: Re: My 4 Pi Build

Posted by [Unity_Coupled](#) on Tue, 19 Sep 2023 20:32:08 GMT

[View Forum Message](#) <> [Reply to Message](#)

I guess I'm more of a PCB traditionalist. It looks a little cleaner with the components mounted on the blank side too...not that it matters, it just satisfies my pseudo-OCD or whatever you call it. I plan to mount mine with 1/4" nylon standoffs.

I'm getting some estimates for having the terminal plates laser engraved...because, why not? I'm pulling out ALL the stops with this build. This is roughly how I want them to look (terminal plates are Dayton SBPP-BK):

File Attachments

1) [terminal_plate.jpg](#), downloaded 313 times

Subject: Re: My 4 Pi Build

Posted by [Wayne Parham](#) on Tue, 19 Sep 2023 21:38:18 GMT

[View Forum Message](#) <> [Reply to Message](#)

Sweet!

Subject: Re: My 4 Pi Build

Posted by [Unity_Coupled](#) on Tue, 10 Oct 2023 17:20:54 GMT

[View Forum Message](#) <> [Reply to Message](#)

Progress on the build has been pretty slow lately as I've had to prioritize farm and vineyard work, as well as audio repairs for customers. Just a few small updates for now...

The terminal plates are back after getting laser engraved. I think they turned out nicely. I went with a slightly different design than what I posted above. If anyone wants to copy this, feel free to PM me for a vector file.

Yesterday I picked up a couple sheets of MDF along with Walnut veneer. I unrolled the veneer sheet and sandwiched it between the fiber boards so it would start to flatten out.

I purchased all the fasteners for the drivers from McMaster. For anyone interested, this is what I ordered:

Woofers

91251A550 Black-Oxide Socket Head Screw, 1/4"-20 x 2"

90975A307 Steel Tee Nut 1/4"-20

Waveguide

91255A278 Black-Oxide Button Head Hex Screw, 10-32 x 2"

90975A306 Steel Tee Nut 10-32

Crossover boards

94639A342 Nylon Spacer, 5/16" OD, 1/4" Long, for Number 8 Screw Size

That's all for now!

File Attachments

- 1) [plate_a.jpg](#), downloaded 222 times
 - 2) [plate_b.jpg](#), downloaded 229 times
 - 3) [ive_got_wood.jpg](#), downloaded 224 times
 - 4) [fasteners.jpg](#), downloaded 220 times
 - 5) [wgscrew.jpg](#), downloaded 220 times
-
-

Subject: Re: My 4 Pi Build

Posted by [Wayne Parham](#) on Tue, 10 Oct 2023 19:03:08 GMT

[View Forum Message](#) <> [Reply to Message](#)

Gorgeous! Those are stunning!

Hopefully I sent the "Care and feeding of your H290C Waveguide" document with the waveguide/horns. It mentions an option of painting with enamel to get a perfect finish. With the rest of the attention to detail in your speakers, you'll definitely want to take that step.

Lightly sand the face using 600 grit on a sanding block. Not much - just enough to remove the mold parting line. Don't sand any part of the flare, just sand the face. Then paint with spray enamel. You can take the waveguides to an auto paint shop if you want, but believe it or not, you can do a great job with a "rattle can" spray bottle.

Subject: Re: My 4 Pi Build

Posted by [Unity_Coupled](#) on Tue, 10 Oct 2023 21:53:55 GMT

[View Forum Message](#) <> [Reply to Message](#)

Thanks. I did look over the Care and Feeding document. The touch-up is on my to-do list, but I'll probably wait until I'm closer to final assembly.

Subject: Re: My 4 Pi Build

Posted by [Wayne Parham](#) on Tue, 10 Oct 2023 22:14:24 GMT

[View Forum Message](#) <> [Reply to Message](#)

Super groovy cool!

Subject: Re: My 4 Pi Build

Posted by [Unity_Coupled](#) on Sun, 15 Oct 2023 04:18:24 GMT

[View Forum Message](#) <> [Reply to Message](#)

I may have goofed on the 1/4-20 screws and bought ones that are too long, since they are only partly threaded. It looks like the 2" ones are going to bottom out before applying sufficient clamping force to the frame of the woofer, since it will be mounted flush with the baffle. I've re-ordered the screws, this time in 1.5" length. (part no. 91251A546)

Just thought I'd put this out there in case anyone was going to copy my McMaster order.

Subject: Re: My 4 Pi Build
Posted by [Wayne Parham](#) on Sun, 15 Oct 2023 14:35:30 GMT
[View Forum Message](#) <> [Reply to Message](#)

What a bummer! Then again, as problems go, that's a good one - super-easy to solve!

Subject: Re: My 4 Pi Build
Posted by [Unity_Coupled](#) on Mon, 16 Oct 2023 18:15:29 GMT
[View Forum Message](#) <> [Reply to Message](#)

Potentially there's another issue, this one not so easy (or cheap) to resolve. I suspected from the get-go that at least one of my drivers was reconed, due to the over-application of glue around the dust cap on one of the cones, and the absence of a part number stamped on the backsides. Connecting a battery with the positive end to the red terminal draws the cone inward, so the polarity is correct. I built a jig for plotting impedance with REW and this is what I measured (average of four sweeps for ea. driver):

Compared to the JBL data, the impedance is not as smooth above 500hz, but it doesn't seem particularly bad either. As you've said in another post, the impedance notch at around 1k is a good indicator that the cone is aftermarket.

I have a single 2226H with an original cone and may decide to sell the 2226HPL's to purchase a second original H, but truthfully I prefer the HPL for the black outer ring. In any case, I'm going to wait until I can conduct final FR measurements and listening tests before making any decisions. I paid about \$300 for both drivers, and if they're good enough I'm inclined to keep using them.

File Attachments

1) [impedance plot.jpg](#), downloaded 141 times

Subject: Re: My 4 Pi Build
Posted by [Wayne Parham](#) on Mon, 16 Oct 2023 19:04:53 GMT
[View Forum Message](#) <> [Reply to Message](#)

Unity_Coupled wrote on Mon, 16 October 2023 13:15Potentially there's another issue, this one not so easy (or cheap) to resolve. I suspected from the get-go that at least one of my drivers was reconed, due to the over-application of glue around the dust cap on one of the cones, and the absence of a part number stamped on the backsides.

...

Compared to the JBL data, the impedance is not as smooth above 500hz, but it doesn't seem particularly bad either. As you've said in another post, the impedance notch at around 1k is a good indicator that the cone is aftermarket.

...

I'm going to wait until I can conduct final FR measurements and listening tests before making any decisions. I paid about \$300 for both drivers, and if they're good enough I'm inclined to keep using them.

I would do the same thing. Measure the response to know for sure.

Even if it's not, a recone isn't too expensive and will make the driver 100% good as new. That's one of the really great things about the 2226H driver.

Subject: Re: My 4 Pi Build

Posted by [frederf69](#) on Fri, 10 Nov 2023 19:51:17 GMT

[View Forum Message](#) <> [Reply to Message](#)

Thank you for this; these little details can be so important. I have not built/ put together a speaker before, but I'm seriously thinking about the 4Pi with the JBL2226H MW & B&C DE250 CD. Just one question please - how is the compression driver attached to the waveguide? H290C

Subject: Re: My 4 Pi Build

Posted by [Wayne Parham](#) on Fri, 10 Nov 2023 20:21:51 GMT

[View Forum Message](#) <> [Reply to Message](#)

The compression driver mounts onto the horn with a couple of 1/4-20 bolts that are spaced 3" apart. Each mounting bolt is 1-1/2" from the center. Some call this the "standard two-hole mounting pattern."

In the case of the B&C DE-250, you could use 1/4-20 bolts but they include a couple of studs and nuts with that compression driver so I personally always use 'em.

Subject: Re: My 4 Pi Build

Posted by [frederf69](#) on Fri, 10 Nov 2023 22:38:45 GMT

[View Forum Message](#) <> [Reply to Message](#)

Thank you, much appreciated 8)
