

---

Subject: 4PI Plans Request

Posted by [Ziggin](#) on Sat, 23 May 2015 08:51:01 GMT

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Hi.

Plans request for 4PI speaker, please.

I have the JBL 2226 15" Woofer.

I'm choosing between the JBL and B&C driver. What is sonic difference between the DE250 and the JBL 2426?

Thanks

Per

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Subject: Re: 4PI Plans Request

Posted by [Wayne Parham](#) on Sat, 23 May 2015 11:56:56 GMT

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You've got mail!

Both the JBL 2426 and B&C DE250 drivers are nice and smooth. They're comparable in terms of sonic quality. The JBL is a little more laid back and doesn't quite reach as high but it's a great driver. We used them for many years prior to switching to the DE250.

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Subject: Re: 4PI Plans Request

Posted by [Ziggin](#) on Sat, 23 May 2015 16:58:48 GMT

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Thank you for the plans.

Looks like it will be the DE250. The JBL driver is much more expensive here.

Can't find any recommendation for a suitable horn.

M7, M10, M15, M20 or M45. Thinking of buying the M45?

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Subject: Re: 4PI Plans Request

Posted by [Wayne Parham](#) on Mon, 25 May 2015 14:15:28 GMT

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The design requires our H290C waveguide. No substitutions are suitable.

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Subject: Re: 4PI Plans Request  
Posted by [Rustydogg](#) on Wed, 15 Nov 2017 06:40:49 GMT  
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Wayne, I would be very grateful if you could send me a set of the 4PI plans. Many thanks.

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Thu, 16 Nov 2017 14:32:20 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [Chas1980](#) on Wed, 20 Dec 2017 22:08:20 GMT  
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Wayne,

I would be very grateful if you could send me a set of the 4PI plans.

Merry Christmas and Happy New Year!

Chas.

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Thu, 21 Dec 2017 14:36:34 GMT  
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You've got mail!

And Merry Christmas to you too!!!

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Subject: Re: 4PI Plans Request  
Posted by [acamilicko](#) on Mon, 25 Dec 2017 17:00:04 GMT  
[View Forum Message](#) <> [Reply to Message](#)

---

Hi dear Wayne, Marry Christmas!  
I have recently got one JBL2226, while waiting on one more considering what to build. These 4Pi look so cute! If I could get plans I would be very grateful.  
Cheers!  
Alex

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Mon, 25 Dec 2017 18:33:37 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [booangler](#) on Sat, 06 Jan 2018 18:11:24 GMT  
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---

Hi Wayne,

I know that I have asked for these plans once before but I am not able to locate them. Can you please provide me with the plans? Thank you

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Sat, 06 Jan 2018 19:22:52 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [Quaker](#) on Sat, 28 Apr 2018 22:25:44 GMT  
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Plans Please

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Sun, 29 Apr 2018 14:24:16 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [Casmick](#) on Mon, 30 Apr 2018 13:42:17 GMT  
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Could you send me the plans too? Thank you very much

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Mon, 30 Apr 2018 15:24:34 GMT  
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You've got mail too!

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Subject: Re: 4PI Plans Request  
Posted by [MH Lumber](#) on Tue, 08 May 2018 22:02:29 GMT  
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---

Wayne would you be so kind as to send me a set of the 4pi plans. I have never heard then before, but really enjoyed the limited time I spent with the 3PI at LSAF last weekend. My room is 16x24 with 9' ceilings. I plan on building my own cabinets but will be buying everything else from you.

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Tue, 08 May 2018 22:36:56 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [MH Lumber](#) on Fri, 18 May 2018 14:27:04 GMT  
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Hey Wayne,

Wondering if you have ever experimented with the BEYMA TPL-150H as the tweeter in the 4PI?

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Fri, 18 May 2018 15:17:09 GMT  
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Our speaker is specifically designed to use our H290C waveguide, which uses an OSEC flare. This produces the smoothest wavefront launch possible, due to its seamless transition from plane wave to spherical section. That's what makes a waveguide special, and what sets it apart from traditional horns.  
H290C Horn/Waveguide Information

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Subject: Re: 4PI Plans Request  
Posted by [jeffx](#) on Sun, 01 Jul 2018 12:47:50 GMT  
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---

Wayne, please send me the plans for the Four Pi. Thanks!

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---

Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Sun, 01 Jul 2018 16:21:26 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [grimberg](#) on Fri, 10 Aug 2018 21:35:40 GMT  
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---

May I have a copy of the 4Pi speaker plans?

Thanks

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Sat, 11 Aug 2018 14:23:00 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [mikeincalgary](#) on Wed, 19 Sep 2018 23:05:09 GMT  
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---

Wayne, please send me the plans for the Four Pi. Thanks!

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Thu, 20 Sep 2018 14:13:29 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [DavidM](#) on Sat, 17 Nov 2018 13:35:19 GMT  
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---

Just bought two JBL 2226h from a guy. He had a couple of 4pi speakers playing in his living room and suggested that maybe that was something for me.

They sounded really nice and then I don't have to experiment with my own setup...

So, could I please ask for the plans for the 4pi?

Thanks a lot, looking forward to reading on this forum. :)

Best regards  
David

---

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Subject: Re: 4PI Plans Request

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Posted by [Wayne Parham](#) on Sat, 17 Nov 2018 15:09:13 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [kdlstrinu](#) on Sat, 22 Dec 2018 04:34:16 GMT  
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---

Wayne, please send me the plans for the Four Pi. Thanks!

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Sat, 22 Dec 2018 16:16:08 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [tomkristian](#) on Thu, 17 Jan 2019 20:44:01 GMT  
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---

I would like the plans as well!

I have a pair of Denovo DE350, correct me if I'm wrong, but aren't these almost exactly the same as DE250 from B&C?

And where can I get the horn?

---

Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Thu, 17 Jan 2019 21:22:27 GMT  
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---

You've got mail!

I have not measured the Denovo DE360, so I cannot say how well it will work in place of the B&C DE250. But I have read that it is a DE250 copy.

As for the H290C horn/waveguide, click the link below to get it:  
H290C Horn/Waveguide

---

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Subject: Re: 4PI Plans Request  
Posted by [Damkel](#) on Tue, 19 Feb 2019 19:32:15 GMT  
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---

Hi

Could I please ask for the plans.

I already have both JBL 2226h and B&C DE250 and have tried to make an active speaker both I have trouble with hisss sound from my Minidsp so I want to try something else.

Thank you very much :)  
David

---

---

Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Tue, 19 Feb 2019 22:00:44 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [jheredia](#) on Sun, 31 Mar 2019 01:53:31 GMT  
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---

Plans request for 4PI speaker, please.

I have the JBL 2226 15" woofer. I'm choosing between the JBL and B&C driver. Just wondering if an Eminence Alpha 15A will work? Thank you for any help.

James H.

---

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Sun, 31 Mar 2019 15:59:59 GMT  
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The JBL 2226H sounds very good in the four Pi cabinet. You cannot use the Eminence Alpha 15A because it has very different electro-mechanical specs. The design requires either the JBL 2226H or the Eminence Omega 15A. The JBL driver is the better of the two because it has a flux-stabilization ring to reduce distortion.

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Subject: Re: 4PI Plans Request  
Posted by [Luithien1](#) on Sat, 06 Apr 2019 22:28:53 GMT  
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---

Might I please have the plans for the 4pi?  
I have my JBL 2226s ready to go.

Thank you,  
John

---

---

Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Sun, 07 Apr 2019 00:09:23 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [Luithien1](#) on Sun, 07 Apr 2019 14:09:57 GMT  
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---

Wayne,

I suspect I may be doing something wrong, but received your "You've got mail" notice, but without attachment.

Is there some trick to viewing the 4Pi plans I should know?

Thank you,  
John  
Luithien1

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Sun, 07 Apr 2019 15:36:58 GMT

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The plans were sent separately to your gmail account.

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Subject: Re: 4PI Plans Request  
Posted by [jtwrace](#) on Tue, 16 Apr 2019 13:44:41 GMT  
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---

Can I get them too? 8o

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Tue, 16 Apr 2019 14:58:32 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [Chris8h](#) on Sun, 02 Jun 2019 20:01:53 GMT  
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---

Hi!  
Kan you send meg the plans too?

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Mon, 03 Jun 2019 14:41:50 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [daemonix](#) on Tue, 11 Jun 2019 17:24:47 GMT  
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---

Hi, Can I please have the plans too?

---

I have 2 2226H and Im looking to build a pair of speakers ... WAF permitted :)  
Cheers from London

---

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Tue, 11 Jun 2019 19:31:24 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [dkalsi](#) on Mon, 01 Jul 2019 14:12:09 GMT  
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---

Hi Wayne,

I'd like to request plans for Pi4 as well.

Thanks,  
D

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Mon, 01 Jul 2019 15:40:27 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [bigyank](#) on Mon, 01 Jul 2019 19:26:34 GMT  
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---

Hi Wayne,

I'd like to request plans for Pi4 as well.

Thanks!!!

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---

Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Tue, 02 Jul 2019 00:53:10 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [malyh](#) on Wed, 25 Sep 2019 09:38:36 GMT  
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---

I'd appreciate your plans for JBL 2226h and B&C DE250. Thank you in advance, mh

---

---

Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Wed, 25 Sep 2019 13:38:38 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [malyh](#) on Thu, 26 Sep 2019 07:30:14 GMT  
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---

Dear Wayne,

thank you for plans! I've just realized that my 2226 are 16 Ohm version (no H ones) Could the Pi 4 be done with them? Do you have by any chance a crossover for this "J" version of 2226?

Thank you, mh

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Thu, 26 Sep 2019 15:18:17 GMT  
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---

Some people have reported using the 2226J in a modified design, but I have not seen measurements of such a speaker, nor have I made any measurements myself. So I don't know

---

how much of a change there is.

People that modify the crossover for a 2226J double the inductor values and half the capacitor values in the woofer circuit. They also attenuate the tweeter 3dB to match the voltage sensitivity of the 2226J. This is done by changing R1/R2 values as shown in the chart below:  
Compensation Component Values

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Subject: Re: 4PI Plans Request  
Posted by [bigyank](#) on Thu, 26 Sep 2019 15:37:46 GMT  
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One could always get those 2226J's reconed as 2226H and you'd be starting with brand new woofers for your brand new pair of 4 Pi speakers.

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Thu, 26 Sep 2019 16:10:16 GMT  
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Absolutely.

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Subject: Re: 4PI Plans Request  
Posted by [Esj](#) on Sun, 01 Dec 2019 18:20:15 GMT  
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Hi Wayne!

Just bought 2226H's and other stuff, so may I have plans also for 4Pi, thanks!

Waveguides that you are selling; is that 50\$ price for a pair or piece?

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Sun, 01 Dec 2019 18:50:51 GMT  
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You've got mail!

Waveguides and crossovers are sold individually, so if you want a stereo pair, you'll need to buy two.

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Subject: Re: 4PI Plans Request  
Posted by [mathiasb](#) on Mon, 09 Dec 2019 14:34:24 GMT  
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Hello!

I'd like a set of 4Pi plans please. Got two 2226H drivers and looking for something to build. Perhaps with 4 channels and a 2x4 MiniDSP I can forego the crossover.

Has anyone heard or compared 4Pi to the DIYSG HTM-10?  
<https://www.diysoundgroup.com/home-theater-speaker-kits/home-theater-series/home-theater-monitors/htm-10-kit.html>

Thanks  
Mathias

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Subject: Re: 4PI Plans Request  
Posted by [Barryso](#) on Mon, 09 Dec 2019 15:13:04 GMT  
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---

I've not heard the HTM-10's. There are a number of threads on other forums that go into detail about the DIYSG speakers and their designers seem well spoken and diligent. There are many folks that have built them that like them.

Thing is, you already have the 2226h woofers. These aren't the entry level woofers for the 4 pi's but the full blown upgrade woofer. They are also the single most expensive part in the 4 pi build - about \$1000 for a brand new pair. It's a great woofer even when you have to buy them retail but you already have them ... IMHO it'd kinda be a shame to ignore them.

My \$0.02.

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Subject: Re: 4PI Plans Request  
Posted by [mathiasb](#) on Mon, 09 Dec 2019 15:42:36 GMT  
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Barryso wrote on Mon, 09 December 2019 09:13 I've not heard the HTM-10's. There are a number of threads on other forums that go into detail about the DIYSG speakers and their designers seem well spoken and diligent. There are many folks that have built them that like them.

Thing is, you already have the 2226h woofers. These aren't the entry level woofers for the 4 pi's but the full blown upgrade woofer. They are also the single most expensive part in the 4 pi build - about \$1000 for a brand new pair. It's a great woofer even when you have to buy them retail but you already have them ... IMHO it'd kinda be a shame to ignore them.

My \$0.02.

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Thank you for your reply! I currently have the HTM-10's myself, but have only had them for less than a year, and paired with a subwoofer all this time. I haven't given them the chance to see "what they can do".

My plan for the JBL's was to build MBM modules, or to perhaps build the 4Pi speakers and replace the HTM10's in the living room. I have to do some more research - if it is possible to build the 4Pi with an active crossover (MiniDSP) instead of an active one, I might try that first.

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Subject: Re: 4PI Plans Request

Posted by [Wayne Parham](#) on Mon, 09 Dec 2019 16:47:23 GMT

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You've got mail!

I agree with Barry about the JBL 2226H. It is an excellent midwoofer. The flux stabilization ring in the motor structure reduces distortion down to the levels normally only seen in horns. When combined with a horn tweeter, you have a system that is very smooth and distortion free.

Also compare the H290C waveguide to the SEOS12. The H290C is measurably smoother. I considered using the SEOS12 at one time, but I wasn't happy with its performance. It has peaks that must be smoothed with notch filters in the crossover. So I designed the H290C waveguide specifically to allow an upgrade path beyond that.

H290C Horn/Waveguide

Don't get me wrong - SEOS enthusiasts are very much like Pi Speakers enthusiasts. And their waveguides and loudspeaker designs are very good. In fact, when they started out, many of them were regulars here and on (Zilch) Evan Flavell's "Econowave" threads. Pi Speakers is sort of like the grandfather design for Econowave and SEOS speakers. The loudspeaker models here were inspirations for their designs.

That's why I considered using the SEOS waveguide when they first started out. I had a wood horn/wavguide that provided constant directivity, but it was very expensive. My other option was a radial horn that had nearly constant-directivity. This was much more popular because of its cost. So I was looking for an upgrade path for the radial horn using a horn/waveguide of approximately the same physical dimensions.

At that time, about ten years ago, the guys that are now DIYSG were talking about making a waveguide too. Back then, I thought we might work together. And like I said, many of them were regulars on this forum and on the Econowave thread. We were all very much kindred spirits.

But we diverged mostly on the points of acoustic loading. We agreed on pretty much all other aspects. I personally do not like waveguides that deoptimize acoustic (horn) loading because they become excessively resonant and require notch filters in the crossover to avoid peaks in response.

So I chose to have an injection mold made for the H290C horn/waveguide, which was very much like the expensive wood horn/waveguide I offered at the time. The H290C does everything I want

it to do, at a reasonable cost. It provides constant directivity and is very smooth, not needing notch filters in the crossover.

And speaking about the crossover, I suggest that you stick with the passive crossover as shown in the plans. You could employ an active crossover, but it must have the exact same transfer function as the passive crossover or you would be degrading performance rather than improving it.

I use a digital active crossover to design the passive crossover. It uses an impedance chart in the form of a ZMA file to incorporate the actual electro-mechanico-acoustic load of the drivers in the system. See the link below for more information about the process.

Crossover optimization for DI-matched two-way speakers

Systems with active crossovers have their benefits, but first-things-first: To get amplitude and phase response right, we need either to include the driver's electro-mechanico-acoustic interaction directly with the passive components, or if isolated using an active filter, we need to be able to employ a ZMA file or some other way of including the load impedance.

It's an Nth degree thing. You can definitely make a great loudspeaker without this kind of precision. It's like making a hotrod car with a carburetor and distributor with ignition points. You can make some awesome stuff with that technology. But if you have a computer sensing oxygen and detonation, you can get even better performance.

While some might see the passive crossover to be more akin to the carburetor, it's not the case. The passive crossover has been dialed-in with the computer. So in this case, the passive crossover is the one that is the Nth degree solution.

An active crossover that didn't exactly emulate the transfer function described above would be more like the computer controlled carburetors of the 1980s. It wouldn't be exactly right. Sort of like how the computers in the 1980s cars couldn't detect detonation and their narrow-band oxygen sensors don't have the ability to provide an accurate signal. They couldn't rapidly change the air/fuel mixture or set the ignition timing. So even though those 1980s cars had computers, they didn't offer much in the way of performance. Same could be said of an active crossover that wasn't dialed in, but instead used generic filter functions.

The only way to get an active crossover to give a true benefit would be to employ a digital filter like I use for designing, one that has an impedance plot of the drivers in the system. It would then give the exact same transfer function as the passive unit.

And one last thing. Not something you asked about but worth mentioning anyway. I highly recommend flanking subs be used. They work very well with my mains or with DIYSG speakers. They are a subset of the multisub concept, which is another thing I advise. But if you want to start small, use two flanking subs and then later add another sub or two, placed further away. I call the distant subs "distributed" multisubs, to distinguish them from flanking subs. But both "flanking subs" and "distributed subs" are parts of a total multisub setup.  
Flanking subs and multisubs



Subject: Re: 4PI Plans Request  
Posted by [mathiasb](#) on Mon, 09 Dec 2019 17:40:24 GMT  
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Wayne Parham wrote on Mon, 09 December 2019 10:47  
You've got mail!

I agree with Barry about the JBL 2226H. It is an excellent midwoofer. The flux stabilization ring in the motor structure reduces distortion down to the levels normally only seen in horns. When combined with a horn tweeter, you have a system that is very smooth and distortion free.

[...]

Thank you! Offtopic: Perhaps I'll change my two Ultimax 18's (build thread) from LFE signal to flanking subs, making them extensions of the (current) HTM-10's, versus being on the LFE channel alone. It would however require setting the front speakers to "large", and I have no way of highpassing them in the AVR that way.  
So, I'd need a second stereo amp to do that.

Current:  
(AVR: FL/FR small - 2 subs)  
AVR amp FL/FR pre-out > HTM-10 FL/FR  
AVR amp LFE x2 > MiniDSP 2x4HD > Crest 7.5 > 2x sealed Ultimax 18

Proposed:  
(AVR: FL/FR large - no subs)  
AVR amp FL/FR pre-out > MiniDSP 2x4HD  
MiniDSP 2x4HD > HTM-10 FL/FR  
MiniDSP 2x4HD > Crest 7.5 > 2x sealed Ultimax 18

Then landing Audyssey XT32 on top of all that :), it'd be a challenge but has potential.

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Mon, 09 Dec 2019 18:25:25 GMT  
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I think that's a good way to go. Run the flanking subs with a 100Hz/2nd-order low-passed copy of the signal sent to the main speaker each sub is flanking. Run the mains set to "large" so you blend with the flanking subs. The mains should be able to handle the LF content unless they just really can't handle the low notes or you are pushing them close to their limits. If you're pushing them hard, then high-pass them at their Helmholtz frequency.

This Helmholtz recommendation is, of course, relevant for vented systems. Above the Helmholtz frequency the vent reduces excursion, but below Helmholtz the woofer is unloaded. If sealed, it's

not such a stark a change in excursion but then again, there is no reduction of excursion from the vent. So for sealed woofers, high-pass where excursion becomes a problem either because of IMD or xmax or both. The goal is to run the mains as low as possible for modal smoothing.

The improvements from flanking subs and multisubs are measurable and audible. The effect is anywhere from subtle to striking, but it's always noticeable. Flanking subs make the upper midbass and lower midrange smoother. Male voices, piano, guitar and cello sound clearer. Distributed multisubs make the deep bass smoother. You will notice bass notes that seemed light or even missing before. Sounds like a better foundation.

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Subject: Re: 4PI Plans Request  
Posted by [mathiasb](#) on Mon, 09 Dec 2019 20:59:32 GMT  
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Wayne Parham wrote on Mon, 09 December 2019 12:25 I think that's a good way to go. Run the flanking subs with a 100Hz/2nd-order low-passed copy of the signal sent to the main speaker each sub is flanking. Run the mains set to "large" so you blend with the flanking subs. The mains should be able to handle the LF content unless they just really can't handle the low notes or you are pushing them close to their limits. If you're pushing them hard, then high-pass them at their Helmholtz frequency.

This Helmholtz recommendation is, of course, relevant for vented systems. Above the Helmholtz frequency the vent reduces excursion, but below Helmholtz the woofer is unloaded. If sealed, it's not such a stark a change in excursion but then again, there is no reduction of excursion from the vent. So for sealed woofers, high-pass where excursion becomes a problem either because of IMD or xmax or both. The goal is to run the mains as low as possible for modal smoothing.

The improvements from flanking subs and multisubs are measurable and audible. The effect is anywhere from subtle to striking, but it's always noticeable. Flanking subs make the upper midbass and lower midrange smoother. Male voices, piano, guitar and cello sound clearer. Distributed multisubs make the deep bass smoother. You will notice bass notes that seemed light or even missing before. Sounds like a better foundation.

Totally agree (not that facts need agreeing) about multiple subs, I run two now, independently.

I'd have to get a second amp to do this, so I can DSP the front speakers - however, quick question on the low pass for the subs - how come 100Hz, and not, say, 80, or 120? Is that based on Pi4 (would make sense), or just a starting point in general?

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Mon, 09 Dec 2019 22:45:25 GMT  
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The flanking sub low-pass recommendation of 100Hz second-order is empirical, so you can consider it a starting point and not a hard-fixed number. However, I have found that the slope is always better being gradual than it is being sharper. Fourth-order slopes are too steep. I have also found that low-pass below 80Hz is too low for flanking subs. The range of 100Hz to 120Hz and sometimes as high as 150Hz seems to work best. Much higher than that and the subs become localizeable and draw attention to themselves.

The low-pass and amplitude of flanking subs is set by simultaneous optimization of three things:

1. Amplitude level-setting the subs to the mains, so we gain bass extension at the appropriate SPL. This usually amounts to about 10dB more gain on the subs, because they are usually about 10dB less efficient than the mains.
2. Low-pass that conjugates baffle-step. Cabinets the size of my three Pi and four Pi mains tend to have baffle step in the 100Hz to 200Hz region. Instead of employing compensation in the crossover, we use the flanking subs to provide additional SPL as BSC.
3. Low-pass that mitigates higher-frequency room modes and SBIR from nearest boundaries. The worst anomaly usually comes from the wall directly behind the speakers, but the nearest side wall is sometimes objectionable too, as can be floor bounce. The modal region extends above 100Hz, but distant multisubs cannot be run this high without being localizeable. And the boundary interference notch from the wall behind the speakers seems to almost always be between 80Hz and 120Hz, probably because proximity to the wall behind the speakers is most convenient and/or popular in this range of a few feet. So this makes it useful to have a truncated array in the 80Hz-120Hz region, to counter the interference notches there. The flanking sub and the midwoofer in the mains form a simple two-element array.

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Subject: Re: 4PI Plans Request  
Posted by [Sion](#) on Sat, 14 Dec 2019 02:37:54 GMT  
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Wayne,

After some amount of web surfing, I could be able to reach at here while reading many good reviews on the pi speakers.

I'm starting to think about setting up Hi-Fi audio system again in my house. More than 20 years ago, I used to build vacuum & solid-state amplifiers including one pair of speakers. So, I'm thinking of DIYing both amplifiers and speakers again even though I'm not confident on wood DIYing...

I have couple of questions.

1. Kit means that all the components are provided except for the boxes. So, I need to build the box with some good wood engineering skill.
2. A good quality wood can be purchased at stores like home depot?
3. Can I get advice from you while building the speaker boxes? or do you have very detailed

instructions?

4. I can see some upgrade options for the components for the 4 pi kit. Do you have any sweet spot for the selections?

Finally, I would be very grateful if you could send me a set of the 4 pi plans (this means drawing and instruction?).

Merry Christmas and Happy New Year!

Thanks in advance,  
Sion

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Sat, 14 Dec 2019 15:53:43 GMT  
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copy of the plans. For larger speakers that incorporate a compression tweeter and crossover network, kits also include the crossover, Zobel woofer damper, and all cable assemblies are completed and ready to install. Every kit containing a compression driver also includes the horn flare and the bolts to mount the driver to the horn.

I recommend using only MDF or Baltic Birch. You will probably want to purchase wood at a quality lumber yard, because the large chain retail hardware stores do not usually stock MDF or Baltic Birch. They only sell cheap plywood products and chipboard. Both of those are suitable for many construction projects, but not for loudspeaker cabinets.

Please peruse the Pi Speakers FAQ. I think you will find the answers to all of your questions there, as well as answers to many things you haven't thought to ask yet. The FAQ has information about upgrade options, the differences between models and upgrade choices, build and setup advice and other useful things. And as you start your build, please feel free to document it here and ask questions or make comments along the way.

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Subject: Re: 4PI Plans Request  
Posted by [Valentino Beach](#) on Mon, 16 Dec 2019 03:12:03 GMT  
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Hello Wayne,

Have been following your 4PI design with great interest for over a year now.

Finally I have purchased a pair of 2226H JBL drivers for this project.  
Can you please send me a set of plans to build these speakers.

Thank you,

Gil

---

Subject: Re: 4PI Plans Request  
Posted by [mathiasb](#) on Mon, 16 Dec 2019 04:12:50 GMT  
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Wayne Parham wrote on Mon, 09 December 2019 16:45

The flanking sub low-pass recommendation of 100Hz second-order is empirical, so you can consider it a starting point and not a hard-fixed number. However, I have found that the slope is always better being gradual than it is being sharper. Fourth-order slopes are too steep. I have also found that low-pass below 80Hz is too low for flanking subs. The range of 100Hz to 120Hz and sometimes as high as 150Hz seems to work best. Much higher than that and the subs become localizeable and draw attention to themselves.

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I'm having difficulty finding a good high pass for the mains. Considering they'll be getting a full range signal I want to protect them. The tuning is around 50Hz. With a sub LPF of BU2 100Hz, is BU4/BU3 HPF at 50-60Hz a good start for the mains? After that - there's the playing around with the delays to get the sub and speaker to integrate, before even looking at EQ.

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Mon, 16 Dec 2019 15:48:28 GMT  
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mathiasb wrote on Sun, 15 December 2019 22:12 I'm having difficulty finding a good high pass for the mains. Considering they'll be getting a full range signal I want to protect them. The tuning is around 50Hz. With a sub LPF of BU2 100Hz, is BU4/BU3 HPF at 50-60Hz a good start for the mains? After that - there's the playing around with the delays to get the sub and speaker to integrate, before even looking at EQ.

High-pass at 50Hz fourth-order is fine.

As for the delay, please remember that what we're doing with flanking subs actually requires some delay. The modal range is caused by a multitude of phase interactions from reflected signals. There are multiple reflectors and therefore multiple delays. Each wall, the floor and the ceiling is a different distance and creates a signal with a different delay. So the application of multisubs - flanking subs and distributed subs alike - is to create dense interference, not to create in-phase summing. The purpose is to make the modal field act more like the statistical field, having dense interference to smooth the region.

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Mon, 16 Dec 2019 15:51:06 GMT  
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Valentino Beach wrote on Sun, 15 December 2019 21:12 Have been following your 4PI design with great interest for over a year now.  
Finally I have purchased a pair of 2226H JBL drivers for this project.  
Can you please send me a set of plans to build these speakers.

You've got mail!

---

Subject: Re: 4PI Plans Request  
Posted by [mathiasb](#) on Mon, 16 Dec 2019 16:07:57 GMT  
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Wayne Parham wrote on Mon, 16 December 2019 09:48  
mathiasb wrote on Sun, 15 December 2019 22:12 I'm having difficulty finding a good high pass for the mains. Considering they'll be getting a full range signal I want to protect them. The tuning is around 50Hz. With a sub LPF of BU2 100Hz, is BU4/BU3 HPF at 50-60Hz a good start for the mains? After that - there's the playing around with the delays to get the sub and speaker to integrate, before even looking at EQ.

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Thanks, I'll try that.

To paraphrase - we don't want to add to the speaker's existing response (say, by adjusting delay so the impulse response is matched), but rather complement it where there might be nulls/dips (room) or a natural roll off (below tuning / HPF).

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Subject: Re: 4PI Plans Request  
Posted by [Damkel](#) on Fri, 27 Dec 2019 19:47:03 GMT  
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Hi

Could I please ask for the plans again I somehow lost/deleted the mail.  
Thank you very much :)

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Fri, 27 Dec 2019 23:32:53 GMT  
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Subject: Re: 4PI Plans Request  
Posted by [Birdman](#) on Mon, 30 Dec 2019 04:43:00 GMT  
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Hello Wayne,

May I request a copy of the 4-pi plans?



Hope you had a Happy holidays and are looking forward to the new year,  
Ian S.

PS: Do you appreciate a build log for modified speakers? (I may increase the volume without making too many changes to the front baffle, I have read your comments on taller cabinets having pipe resonances among other things... I can perform measurements. actively crossover with an Audia Flex...)

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Mon, 30 Dec 2019 17:11:47 GMT  
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We all love to see build threads. So please create one and post often!

As for the mods you are considering, I am glad you understand the potential for anomalies from standing wave modes in large full-range cabinets. That knowledge will push you towards diligence in this regard.

For crossover information, please see the following thread:  
Crossover optimization for DI-matched two-way speakers  
Watch the video in that thread too, because it shows you how to find the position of the vertical nulls. The forward lobe is between the nulls.

I also encourage you to look at the concept of flanking subs. They work hand-in-hand with the three Pi and four Pi cabinets, meaning that they increase bass extension and conjugate lower rolloff both from cabinet alignment and from baffle step. In addition, each flanking sub mitigates SBIR from nearest boundaries and it smoothes higher frequency room modes.

By making the cabinets larger, you not only change the position and frequency of internal standing wave modes but you also change the bass alignment and possibly the frequency where baffle step occurs. This might change the overall synergy between the mains and their flanking subs.

So keep these things in mind as you incorporate your changes.

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Subject: Re: 4PI Plans Request  
Posted by [brad n](#) on Fri, 17 Jan 2020 01:49:36 GMT  
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Hi, Wayne.

I'd like to request the plans for the Four. I'm considering this project and would like to get a sense



of the woodwork involved. I'll also be perusing the various build threads here.  
Many thanks!  
Brad

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Subject: Re: 4PI Plans Request  
Posted by [Wayne Parham](#) on Fri, 17 Jan 2020 16:24:38 GMT  
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