

# User Manual - Model 2 Dipole Woofer DSP

*Revision 1.0*



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***Congratulations on your purchase of a unique dynamic dipole woofer designed to complement your panel speaker, whether it is a Magnepan or Electrostatic (Quad, MartinLogan or Sound Lab) !***

As music lover's we feel that dipole planar speakers can offer unique advantages and challenges for the music listener at home. Dipole planar speakers have lower moving mass and smaller displacement than comparable direct radiator speakers and so offer some unique advantages in both transparency and in a sense of spaciousness which provides a more realistic sonic presentation for many types of music. These characteristics are particularly apparent for acoustic music recorded live or in natural acoustic studio settings. Magnepan attributes these characteristics to the dipole power response of the panel speakers which provides a sound devoid of early reflections off your listening room sidewalls which tend to muddle the direct response of the front wave of the speaker, coupled with enhancement of room reverberation effects which mimic what we experience with live music.

A key challenge of medium and large panel speakers is in the reproduction of live SPL's at frequencies below 80 Hz. This is complex problem driven by the physics of a dipole film diaphragm's capability to generate large pressure changes for low frequencies which present very low acoustic impedance to the film surface and which are subject to cancellation except for very large panels. Dynamic drivers have the capability of generating displacements and SPL's an order of magnitude larger than film diaphragms at low frequencies, however this capability comes with some drawbacks, including the power response of the acoustic suspension and bass-reflex cabinets required to equalize the dynamic driver's inherent frequency response via Theile-Small parameterization.

The planar dipole characteristic is key to understanding the benefits and risks of adding a dynamic woofer to a panel speaker. ***While the incompatibility of panel speakers and dynamic woofers has been ascribed to driver "speed" or other factors, the real issues are incompatible power response through the crossover region, and dynamic driver cabinet resonance and energy storage in the cabinet itself.*** These issues were identified and very successfully conquered for dynamic drivers by the late Siegfried Linkwitz whose LX521 open baffle dipole design remains one of the best dynamic loudspeakers ever built. Linkwitz realized that the use of electronically equalized dynamic drivers in specialized open baffle cabinets could provide flat acoustic response in real listening rooms without many of the problems that Theile-Small designed cabinets present. The VPE Model 2 Dipole Woofer DSP owes much to insights from Siegfried's pioneering open baffle loudspeaker work which can be found at <http://www.linkwitzlab.com>.

The VPE Model 2 Dipole Woofer DSP, Figure 1, is a unique electronically equalized open baffle dynamic driver with a difference. Based, (loosely), on the Pass / Linkwitz Slot-Loaded Open Baffle (SLOB) loudspeaker, the cubical slot-loaded cabinet is designed to present a high acoustic impedance mouth immediately above the floor, avoiding destructive "floor bounce" interference at the listening position.

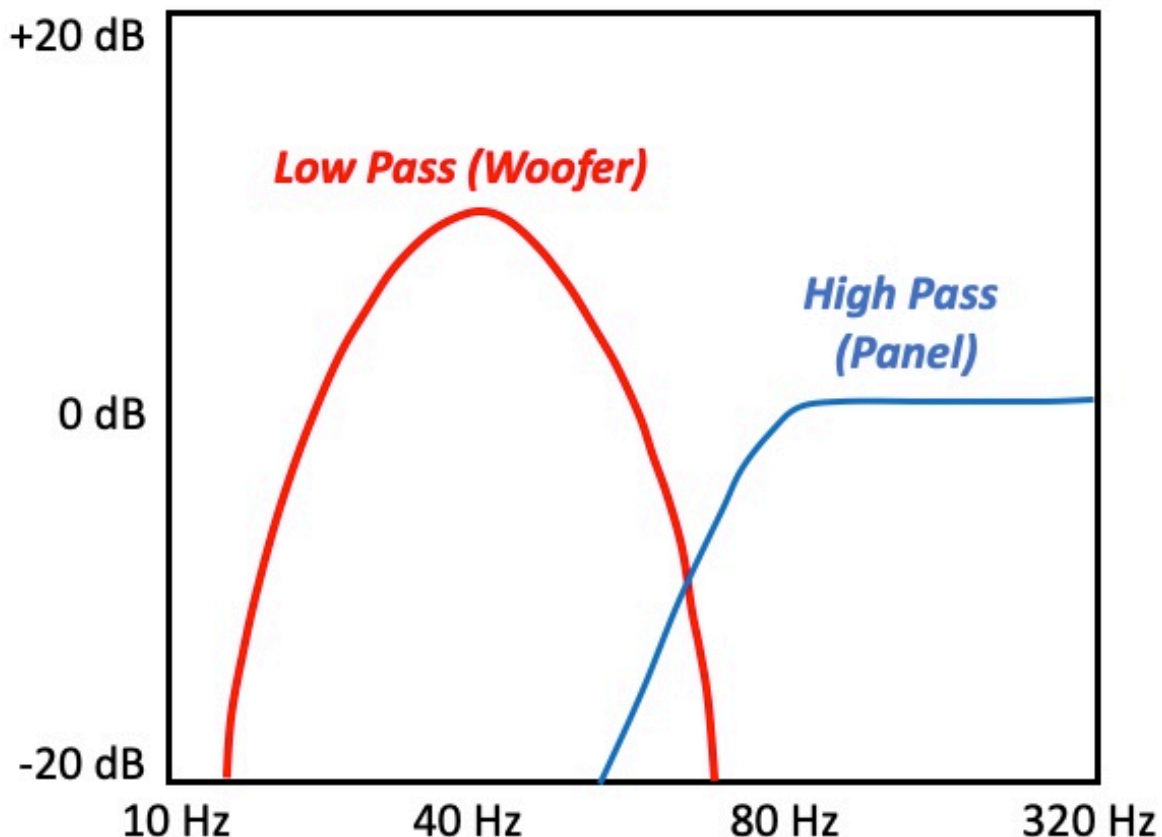


**Figure 1: VPE Model 2 Dipole Woofer Front and Rear Views**

The loaded slot provides increased acoustic impedance to the front wave of the dynamic driver, reducing the amount of equalization required to flatten the 12" driver's response for the frontal radiation which is emitted in-phase with your panel speaker's response. The frontal response is ~3 dB higher than the back wave which comes off the rear-facing aluminum cone and out through two vertical slots in the back of the cabinet, due to the acoustic impedance of the front-facing mouth. The cabinet itself is incredibly strong using 3/4" birch plywood panels, extensive internal bracing, a double wall baffle, plenty of "biscuits," glue and high quality fasteners to prevent cabinet wall flex radiation from distorting the combined speaker response. The cabinet may be finished with high quality cabinet paint, laminate or veneer, depending on your choice, and is topped with a 1/4" thick plate of black acrylic.

The VPE Model 2 combines our unique slot-loaded cabinet with an excellent Dayton Audio 12" aluminum cone RSS315 dynamic driver and the Dayton Audio SPA500DSP 500W amplifier which incorporates one of the most flexible electronic crossover and equalizer capabilities offered to the audio market. The amplifier and driver were designed together by Dayton Audio for high performance subwoofer integration.

**The crossover and equalization settings pre-programmed into your VPE Model 2 Dipole Woofer were generated using pink noise to match all Magnepan speakers using a THX standard 80 Hz second-order crossover and provides for flat frequency response from ~ 25 Hz to over 250Hz, in our studio.** A plot of the pre-programmed DSP filter response is presented in Figure 2, below.



**Figure 2: VPE Model 2 DSP Crossover and EQ Settings**

The default settings for the SPA500DSP amplifier and a screenshot of the excellent Dayton Audio DSP control GUI are provided below. **These are starting points !** You will find that the SPA DSP is quite powerful in tailoring your woofer's response to your panel speakers and your room. Experimentation is

encouraged to receive the best results. This system has been judged by our reviewers to be both better and easier to use than ANY woofer DSP available on the high end market today, and is especially well suited for dipole woofer equalization.

Section	Frequency	Slope	
Subsonic Filter (Opt.)	25 hz	24 dB / Octave	
Low Pass Filter (Woofer)	55 hz	24 dB / Octave	
High Pass Filter (Panels)	80 hz	24 dB / Octave	
Parametric EQ	Frequency	Gain	"Q"
1	15 hz	+2	1.0
2	40 hz	+2	1.0
3	60 hz	+2	1.3
4	80 hz	-12	1.0
5	125 hz	-12	1.0
HP Time Delay	0 ms		
Limiters	Attack 1.0 ms	Release 120 ms	Threshold -7.5 dB



**Figure 3: SPA500DSP Amplifier Default Settings**

Two additional resources for determining your optimal DSP settings are 1) a calibrated pink noise source, the "Flat Pink CD4000" disc provided with your Model 2, and 2) Apple iPhone apps "Real Time Analyzer (RTA)" from Studio Six Digital OR "Octave Band RTA" from the Apple App Store. The built-in microphone in the iPhone is sufficient for setting the DSP levels, but Studio Six Digital also offers an excellent



calibrated microphone which plugs into the iPhone Lightning port for power and data and which is compatible with both of these RTA's.

The correct SPL level match between the woofer and your panel speaker is dependent on the voltage gain of your high pass amplifier and the acoustics of your room. A table of Model 2 DSP gains for many Magnepan LRS-compatible amplifiers is presented in Figure 4, below. **Again, consider these as starting points ! If your power amplifier is not listed in the figure, the Model 2 gain is voltage gain of your panel amplifier MINUS 31 dB. Levels can be verified using the CD4000 disc (Track 2), and an RTA.**

**Tune for level pink noise response from 250 hz down with some slight dropoff below 40 hz to compensate for room gain. In addition, be sure to position the Model 2 in-line with your panel speakers so that its polar response is consistent with the panel speaker polar response through the critical crossover frequency range (40 Hz to 250 Hz). The Model 2 should not be apparent on its own - it should simply augment the performance of your panel speakers when properly tuned and positioned.**

Amp. Mfg.	Model	Power (4 ohms)	Voltage Gain	LDW Gain Setting*
Pass Labs	XA60.8	120W (Class A)	26 dB	- 5 dB
Pass Labs	XA25	50W (Class A)	20 dB	- 11 dB
Pass - First Watt	F6	50W (Class A)	14 dB	- 17 dB
Pass Labs	X150.8	300W	26 dB	- 5 dB
BAT	VK-255 SE	300W	26 dB	- 5 dB
Benchmark	AHB2	190W	23 dB	- 8 dB
Bryston	3B <sup>3</sup>	300W	29 dB	- 2 dB
Parasound	Halo A23+	240W	29 dB	- 2 dB
Schiit	Vidar	200W	22 dB	- 9 dB
Adcom	GFA-555se	300W	27 dB	- 4 dB
Hafner (Radial)	P3100	200W	29 dB	- 2 dB
NAD	C275BEE	150W	29 dB	- 2 dB
Naim	300DR	150W	29 dB	- 2 dB
Emotiva	XPA-2	490W	29 dB	- 2 dB

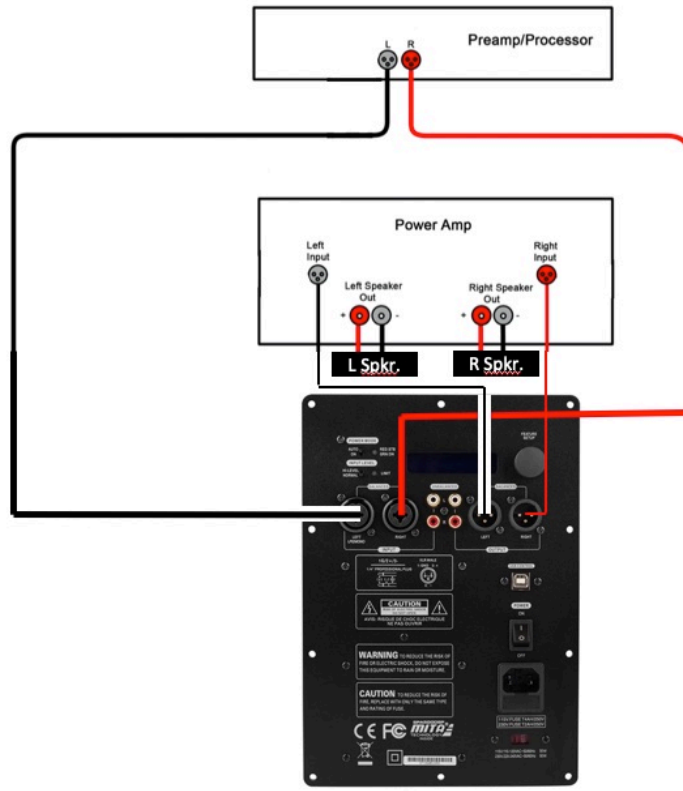
\* LDW Setting ~ Amplifier Gain - 31 dB

**Figure 4: DSP Gain for Magnepan Panel Speakers and Compatible Amplifiers**

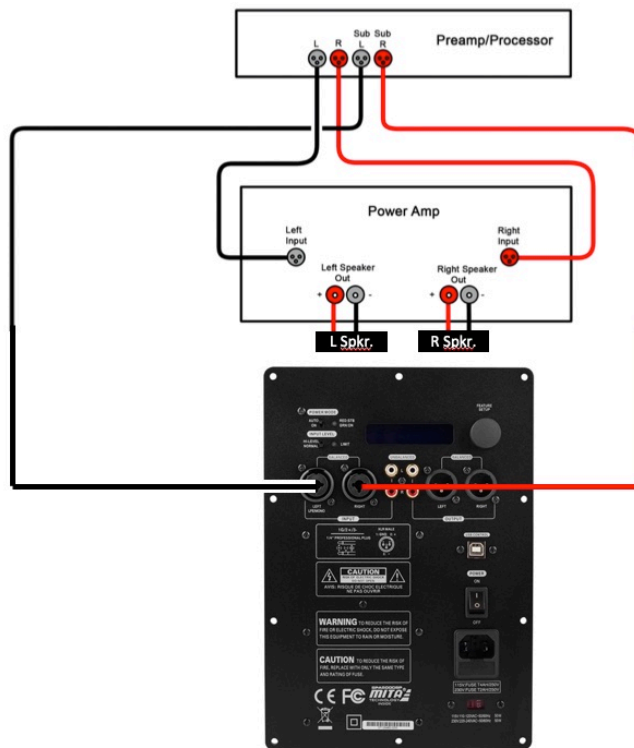
The most expeditious way to program the Model 2 DSP is use of the Dayton Audio's Graphical User Interface (GUI), a laptop PC and a USB-A cable to ties your laptop to the amplifier, as per the Dayton Audio SPA500DSP User's Manual. (Sorry, Mac fans, the GUI is only compatible with the Windows Operating System.) **The GUI Executable can be downloaded directly from Parts Express / Dayton Audio website.** An alternative approach is outlined in the SPA500DSP User's Manual using the rotating button on the amplifier, the alpha-numeric display on the amplifier, and the flowcharts provided in the Dayton Audio manual.

Two hook-up schematics are provided in Figure 5. The first schematic is for use with a basic preamplifier and utilizes the SPA500DSP to provide high pass filtering for your panel loudspeaker. In addition to your panel speaker cables, you will need two pairs of 6-10 foot RCA (unbalanced) or XLR (balanced) cables to connect your preamp to the Model 2 DSP amp and then to connect the Model 2 DSP amp to your power amplifier. The second schematic is for a preamp / processor which includes dedicated subwoofer output(s) and high pass filtering for the main outputs to your power amplifier. (Using your preamp / processor for the high pass filter eliminates an extra A/D and D/A processing step in your system.) **In this case, select a crossover frequency of 80 Hz and a slope of 24 dB/octave, (Butterworth or Linkwitz-**

Riley). Note: if your preamp / processor has one monophonic subwoofer / LFE output only - use the SPA left channel input.



VPE Model 2 – SPA500DSP



VPE Model 2 – SPA500DSP

### **Figure 5: Model 2 Dipole Woofer Hookup Diagrams**

In an optimum set-up, your main dipole panel loudspeakers should be at least ~3' from the back wall, which will put the VPE Model 2 cabinet back panel ~2' away from that wall. The speaker is designed for this positioning, but will also work further out from the wall. **Be sure to align the front of the Model 2 with the front of your panel speakers for best results ! (See this Manual's Cover Photo).** Use your pink noise disc and an iPhone RTA app to achieve a smooth response from 35Hz through 250Hz for your listening room using the SPA500DSP controls.

We recommend Signal Cable RCA / XLR interconnects ([www.signalcable.com](http://www.signalcable.com)), and Audioquest Type 5 or Kimber Kable 4PR or 8PR speaker cables for excellent performance at affordable prices.

For the best possible performance we recommend Pass Labs Class A power amplifiers for Magnepan loudspeakers which greatly benefit from low distortion amplification and sufficient drive current into the panel resistive load. Schitt Audio also provides great preamp and power amplifier choices for ALL Magnepan loudspeakers at very reasonable prices.

BOTH Pass Labs and Schitt Audio are GREAT AMERICAN brands run by legendary audiophiles, (Nelson Pass, Kent English, Jason Stoddard and Mike Moffat), whose designs are informed by the sound of live music.

#### **VPE Model 2 Dipole Woofer DSP Specifications and Drawing:**

*Dimensions: 20" tall x 18" wide x 16" wide*

*Weight: 90 Lb.s*

*Footers: (4) Dayton Audio 1" tall spikes*

*Loaded Slot Dimensions: ~ 2" tall x 15" wide*

*Dynamic Woofer: Dayton Audio RSS315 12" Aluminum Cone - 4 Ohms (700 W capable)*

*Integrated Power Amplifier: Dayton Audio SPA500DSP - 500W into 4 Ohms*

*AC Power Compatibility: 120 or 230 VAC*

*Cables Provided: IEC AC Power and USB-A Data*

