MAC-466 – A collaboration between Midwest Audio Club and JuleFidelity

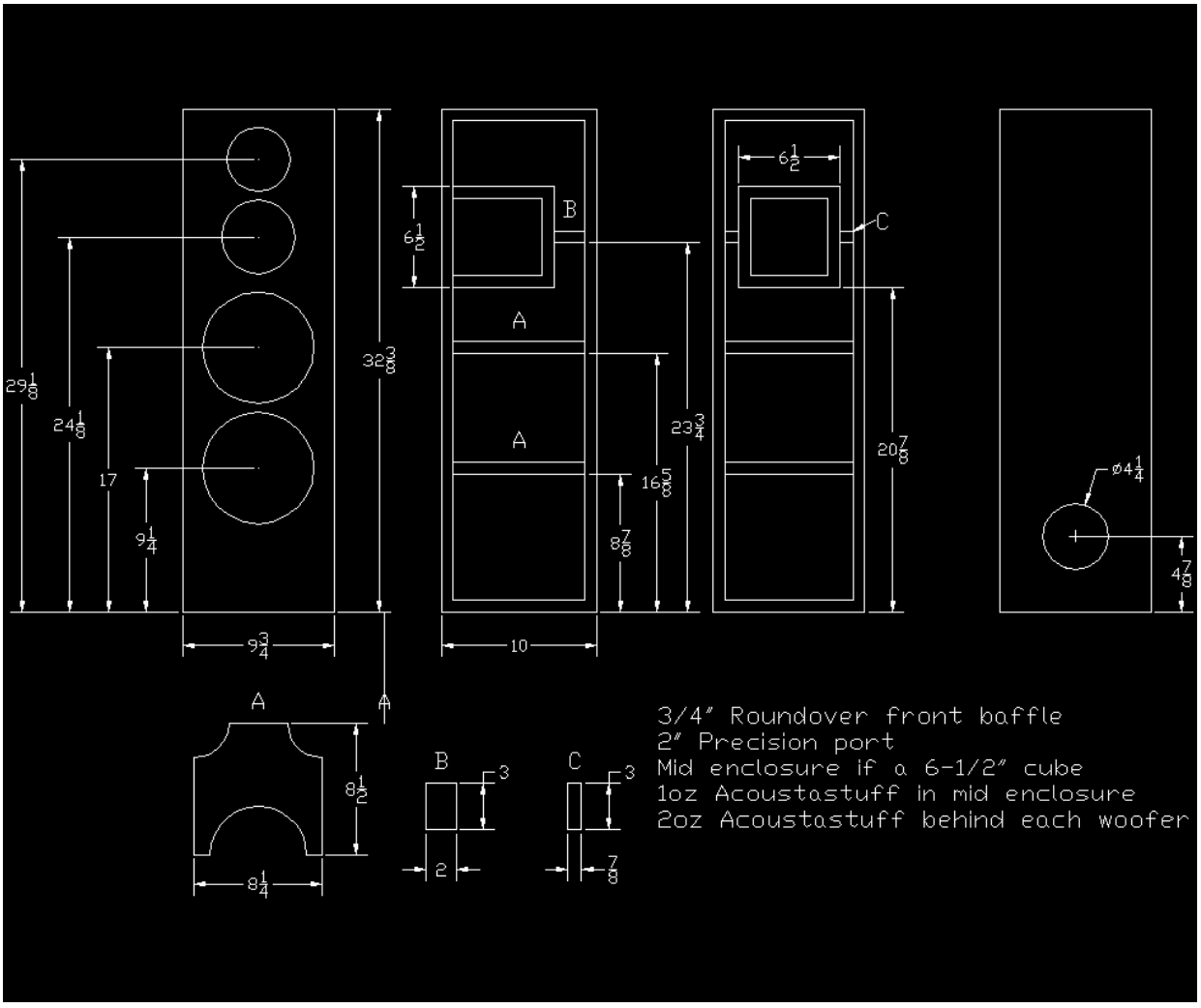
Written by Johnny "JR" Richards

The MAC-466 is a small 3-way tower using a dome tweeter from JuleFidelity, a 4" midrange and dual 6.5" woofers. The midrange and woofers are part of a new line offered by Midwest Audio Club and JuleFidelity.

Design goals from the beginning were to generate a design to showcase the capabilities of our new driver lineup. These drivers offer great value/performance ratio.

This document will not delve too deep into design philosophy or technical aspects, but it will give enough information for the reader to duplicate this build at home. Midwest Audio Club highly recommends JuleFidelity for all component needs as they offer a tremendous value.

Without further ado, here is a CAD drawing of the cabinet. Construction is slightly complicated due to the way we chose to create the midrange chamber and the bracing around it. Feel free to simplify construction by building the midrange enclosure to the same width as the internals of the cabinet. The braces can be simplified, as well.



Here is a picture of the internal construction, to help give an idea of how things go together. The two shelf braces do not necessarily need to be shaped like these – just be sure there is a similar shape:

Materials of construction in this case was particle board shelving from Menards. It has become a popular option for cabinets that have all dimensions smaller than 11-1/4" or so. Total cost for these cabinets in unfinished state is less than $50! That makes this a true budget design.

As can be seen, bracing is extensive for a budget design – you will not see this level of internals in most commercial speakers under $1000.

After extensive measurement and crossover design work, this is the final response we ended up with:

You can see good, deep reverse nulls around each crossover point. This indicates there is good phase tracking between drivers. There is a broad but shallow (less than 3db) depression in the response between 1.5K and 8K – this was deliberate. These speakers are "voiced" to be somewhat laid back but still be rockers. The built-in smiley face makes that possible. Other than for room correction purposes (if that is your thing), little to no EQ will be necessary on these. Crossover points are approximately 490/2300Hz.

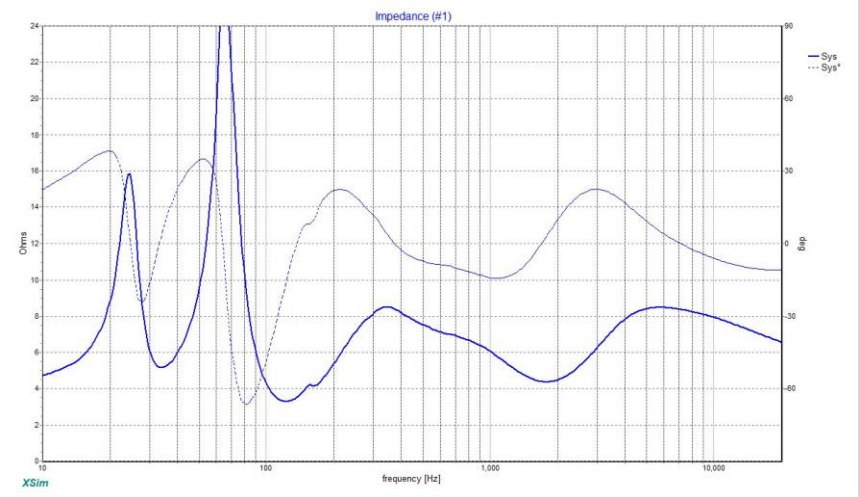
The peak centered at 200Hz is a measurement artifact and can be safely ignored.

Sensitivity of this design is approximately 83db and it is recommended to drive them with at least 25 clean watts. They will handle 100W peaks. Any modern Class D amp with an adequate power supply unit will drive these just fine.

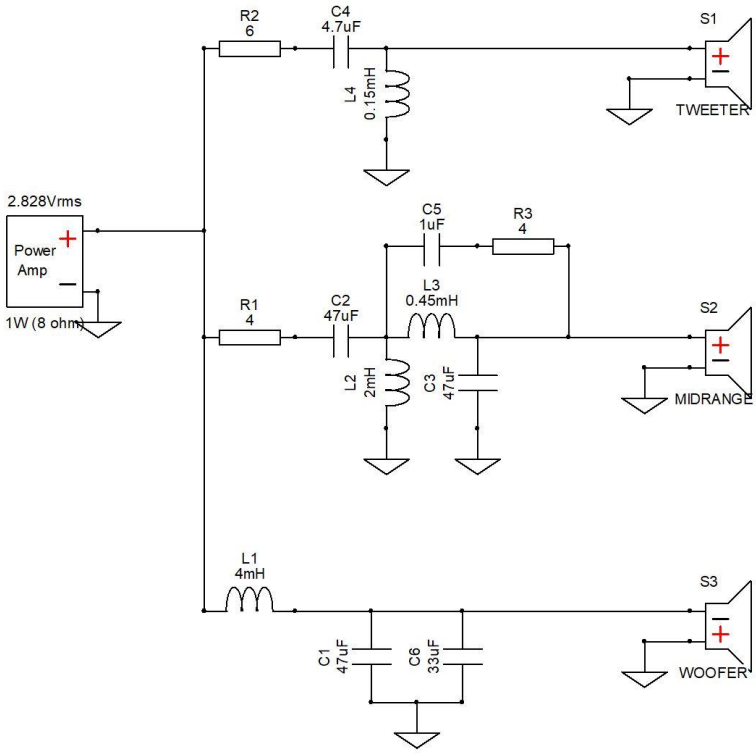
This is a 4 ohm speaker, but it is an "easy" load to drive due to the relative flatness of the impedance curve. We wouldn't personally worry about your power amplifier driving these speakers – we have driven 4 ohm speakers with cheap home theater receivers without problems.

If you do run into issues with your receiver, remember that Class D amps are inexpensive these days and we do recommend that is the route you take to power these. There are numerous amps out there – try to avoid the “good deal” on AliExpress and eBay however. Dayton Audio, FX-Audio, SMSL are all reliable brands. Just be sure you buy a high output power supply. Most included power supplies leave performance on the table.

Here is the impedance:



Here is the crossover (important to note that the woofer is deliberately wired out of phase):



If you have never assembled a crossover, my recommendation is to create an account and make a post on the Midwest Audio Club forum to ask for help on how on assembly. We personally start by laying all the components out exactly as shown in the schematic and then start nudging and rotating them to make the crossover board as small as possible. Be sure to keep orientation of inductors relative to each other following some guidelines. Generally speaking, the coil winding direction on each inductor needs to be at 90 degree angles to other inductors. The forum will be very helpful in getting you to the proper layout.

The original build, however, used two separate crossover boards – one dedicated for the midrange circuit and the other for the tweeter and woofer. You may find you have to do the same in order to physically fit the crossover inside of the cabinet. MAC members can help with that, as well.

We glued one crossover board to each of the lower braces.

Helpful hints (in no particular order):

1. This is a moderately complex cabinet construction. You will need a router and some type of circle jig to build-to-spec. There are plenty of online tutorials for building a DIY circle jig, otherwise we recommend the Jasper Jig.
2. Use 18awg internal hookup wire. Buy it in several colors to distinguish between the different circuits. Parts Express has a small selection of hook-up wire in different colors. ApexJr has a very large selection in many, many colors. Alternatively, plain old OFC "zip" cord can be used – it just requires a little more attention be paid to keep from crossing wires. Color coded tape or zip ties can help in that respect.
3. We recommend the #6x3/4 screws should by Parts Express. They are found here.
4. The port overall length is 4" flare to flare. Going shorter will boost the lower end a bit, going longer will extend it but at the cost of output down low. 4" is the sweet spot in our opinion. Use PVC cement to assemble the port. You can save a few bucks going with the 2" adjustable port available here.
5. For the stuffing behind the lower woofer, work it in and around the port tube towards the bottom. It needs to be packed fairly tight there to help control a "pipe resonance". Blocking the port will result in reduced bass performance.
6. Make sure the midrange enclosure is completely sealed off. This is very important. Drill a ¼" hole through the back of the midrange enclosure to pass the wires through. We then use gobs of hot glue to seal off around the wires. You may have to hold wires straight up while glue cools in order to ensure a full seal.
7. Let this design break in for a few hours. We just play stuff like Tracy Chapman and Aqua at unreasonable volumes to accomplish this. These will really open up after a break-in period.
8. While not fully necessary, it is cool to add spikes to a speaker. We used some old outriggers that were a buyout from Parts Express many years ago. JuleFidelity offers outriggers as well.
9. Carefully measure the drivers before making the cutouts. These were designed to be flush mounted, and the reason the CAD file does not call out the driver dimensions is because there is a tolerance that needs to be accounted for. Download the driver datasheets to get an idea (in metric) of driver cutouts. Don't sweat a millimeter here and there provided the drivers are all properly flush mounted. Not flush mounting will have the biggest effect on tweeter performance, but due to the overall frequency response there is some wiggle room there.

Bill of Materials (including optional aluminum binding post plates – substitute any terminal cup to save a few bucks):

Item	Value	P/N	Qty	Price/Ea	Price?Total
Woofer		MAC-06	4	$30.00	$120.00
Midrange		MAC-04	2	$20.00	$40.00
Tweeter		JF-1204F	2	$19.99	$39.98
Capacitor	47uF	47uF-160v	6	$11.09	$66.54
Capacitor	33uF	33uF-160v	2	$7.79	$15.58
Capacitor	4.7uF	JF-400M-4.7	2	$3.29	$6.58
Capacitor	1.0uF	JF-400M-1.0	2	$2.09	$4.18
Inductor	4.0mH	Coil S18-4.0	2	$9.29	$18.58
Inductor	2.0mH	Coil S18-2.0	2	$7.49	$14.98
Inductor	0.45mH	Coil 20.45	2	$4.19	$8.38
Inductor	0.15mH	Coil 20.15	2	$3.19	$6.38
Resistor	6ohm	JFr-6.0	2	$1.79	$3.58
Resistor	4ohm	JFr-4.0	4	$1.79	$7.16
Precison Port	2"	PSP2-BKNT	2	$14.05	$28.10
Acousastuff*	1lb	260-317	1	$14.98	$14.98
Terminal Plate		NA	2	$13.99	$27.98
*Not currently available from JFComponents					$422.98

If all components are purchased from JFComponents, there will be a discount applied. We believe this to be an excellent value in the price range with all premium components. Many 3-way designs specify electrolytic capacitors for the larger values – it is our opinion it is worth using poly caps instead. JF offers affordable poly caps in the values needed and it is highly recommended these are purchased as a kit.

Resources:

https://diy.midwestaudio.club/discussion/2385/midwest-audio-club-drivers/p1

https://www.jfcomponents.com/

https://www.facebook.com/midwestaudioclub

https://diy.midwestaudio.club/discussion/2409/mac-tmww/p1