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Author: [William](#) on 2002-12-01 at 08:38:20

(Roadfly member #18312; [Roadfly Inner Circle member](#) since 2003-07-15)

Subject: **DIY post - Complete E46M3 H&K; Upgrade (long!)**

(19371 views) (22533 thread views)

Message: E46 M3 Coupe (with H&K;, no NAV) Full Audio Upgrade  
By William Quiles  
12/01/02

Thanks to those who came before me and shared their information with me. They are the ones who deserve credit as they discovered most all of the information presented in here. Please look at the references for some very good sources of information, most specially the post by David Bagby on his lessons learned. He has the CORRECT wiring diagrams, which I used during my install (Yes, my H&K; system has wires where his diagram shows no-connection, but it did not mater during my install). NOTE: To preserve this data (since it is the ONLY post I found that has this information) I have copied his wiring diagram at the end of this post in case his post is ever lost – this information is very valuable!

AS USUAL, THIS INFO IS PROVIDED WITHOUT ANY GUARRENTTEE! THIS IS WHAT I DID & WHAT I HAVE FOUND - USE THIS INFO AT YOUR OWN RISK - I WILL NOT BE RESPONSIBLE IN ANY WAY, SHAPE FOR FORM FOR WHAT YOU DO WITH THIS INFO.

I am not an audiophile, nor do I like very loud music, but I do like clear and quality sound of an stereo system, specially if I am listening to CD's. When I ordered my M3 Coupe (2002, late April production) I figured that the

although it lacks bass. I am on the other hand that thinks that the H&K, is not good enough since I was not happy with the audio system on my car (specially the spatial button!), plus the more I listened to it the more I was convinced that the system just SUCKS big time!. I hesitated for a while about what to do, but eventually decided I could not live with the factory system (music simply did not sound accurate nor "right").

This whole process took about 2 months or so, so I am hoping that by me sharing what I learned it will be easier for those of you who are considering what to do. This post shares what I learned through this process and what I did on my particular car.

When I started I had some simple goals (which might or might not match your own):

- system must sound clear, with good imaging, and slightly louder.
- good, decent bass, although not wanting to win SPL contests.
- retain OEM head unit – no exceptions!
- make the install look 100% factory.
- no significant trunk space loss – preferably none.
- try as much as possible to make changes reversible.
- spend the LEAST amount of money possible.
- try to do all of the work myself (also saves money!)

Not only did I wanted to save lots of money by doing the install myself, but I really wanted to make sure that everything was done as best as possible. While researching for this task saw some photos of installs that were done by local shops that were not done "right", so I studied my options for several weeks until I felt I had enough information to get started (see references/links at the end). Also, by doing the install myself I can tune and balance the system and the stage to MY liking, not somebody else. Lastly, if something went wrong, I have only but ME to blame J

I first upgraded my rear stock OEM subs with the superb Kicker 6x9 Free Air replacements. Quite a few have replaced the factory subs for these for a "quick and dirty" upgrade on the bass department. For some, this will be enough and it will also be the least expensive and by far the easiest upgrade. However, if you are used to larger (10" or larger subs) with amps then this is not going to be good enough by itself. Although the new Kicker subs were a good improvement, I decided I wanted a little bit more "punch" so I decided to use an amp to give more power to my new Kicker subs.

Let me take a moment to say that adding a simple sub and amp for the subs is what most folks need – no more. If you have the factory CD-changer and new rear left panel you already have enough space for a decent, small, 2-channel amp to drive the OEM subs. You will need to add a thin layer of foam around the H&K's sub housing to reduce/eliminate rattle (believe me, if it did not rattle before, it "will" after you use an amp!).

You do not need more than 40 "clean" watts for the factory subs as right now they have FAR less. In fact, just look at the active crossover/amp next to the sub housing and you will see what you can not possibly have much power there at all. It would also be best if you get a small amp that has a built-in crossover for the sub frequencies (150Hz or less) as it will make the install easier. You should also know that there is power and ground going to the sub amp/crossover so you could install the amp to the underside of the rear deck and wired it all there. Some of the links at the end do show some other posts about just adding a sub/amp, so please review those as well before proceeding.

You could wire the sub for the amp directly from the rear or the factory subs, but realize (as I will cover later on) that the OEM amp already cuts the frequency range of all outputs (as it has built-in active crossovers on all outputs), so if you do not bypass the OEM amp you will not have the full frequency range to feed your aftermarket amp. Some have reported excellent sound by taking the rear speakers directly to drive the subs, so you can try it to see what sounds good to you - after all that is what really counts.

Since I decided that I needed an amp for the Kicker subs and since I wanted to replace the front speakers for better sound/image/bass I knew I would be better off by getting a multi-channel amp. After doing some research I found that a six channel amp would work great when configured in this way:

- channel 1 and 2 – front door separates (component speakers)
- channel 3 and 4 – rear fill (provides small ambience for rear passengers)
- channel 5 and 6 – drive the subs

So now I need a 6-channel amp and a good set of quality component speakers. After much research for the amp I realized that if the amp had a built-in crossover to make tuning and balancing the overall system, the install would be easier on me. As you will see in the references, the a/d/s amps came highly rated and always got high marks for being very clear and for having clean power (low distortion at their rated power output). From my research, and since I do not listen to very loud music I found that I only needed about 40-60 watts of "clean" power per channel. Given this I started looking for a 6-channel a/d/s amp and after a month or so I found an used a/d/s P640 (6x40 watts) on Ebay for \$250. Amp down, speakers to go!



- 1) a/d/s 235is or 345is (345 better woofer and crossover but same tweeter as in 235is)
- 2) MB Quart (although some consider them a little bit too bright)
- 3) Infinity Kappas

Out of these I was able to listen to both the Kappas and the MB Quarts, and although I took a risk and was not able to listen to them, I pick the a/d/s speakers as the always got rave reviews for being the most clear and accurate, plus the fact that I already had an a/d/s amp meant that the system will work together for sure. After a couple of weeks I found a new set of 345is on Ebay that came from a closing store's auction so I had my front speakers. Now I needed to figure out how to wire everything together.

In case you were wondering about the rear "fill" speakers, my research (and emails to a/d/s technical support) revealed that the OEM speakers are good enough for fill duty as long as you take the very low end frequencies (feed those to the sub) and the high frequencies (only the front speaker set gets these as to not to confuse the imaging/staging). So far this is working great, although I can always upgrade those in the future if I want something with higher quality.

So I started looking in the Internet for audio upgrades for BMW's and I soon found that late model BMW head units work hand-in-hand with the H&K OEM amplifier. Unfortunately, the H&K amp (and I am talking here about the "main" amp, not the Mickey Mouse, tiny amp for the subs) uses built-in crossovers, which means that the amp and the speakers are matched to each other and that the outputs of the amp already have reduced frequency range. This means that if you take the output of the OEM amp to an aftermarket amp to drive your speakers you will never have a "pure" signal available. This is not terrible (it is actually a good design from BMW and H&K;) but means that once you decide to upgrade your system you HAVE to replace the main amp as well.

I also learned (and this is REALLY important) that the OEM head unit in our cars does not use the "standard" RCA signals prevalent in aftermarket stereos, but the much better differential output signals. This means that you "CAN'T" directly connect the outputs from the head unit into an aftermarket amp – you need a converter. There are a few recent aftermarket amps that can take the diff signal directly, but most can't (check BEFORE you get your amp). My amp is one of those that does not, but luckily for me Peripheral makes one that works perfect with my a/d/s amp, the Vendetta 4 (also called VEN4 for about \$40). I am using it and I can tell you it works!

My a/d/s amp is driving speakers with the following frequency ranges, plus I am using a "relative" scale of 1-10 for power:

- front speakers: power 6, high pass at about 50Hz or so
- rear "fill" speakers: power 2-3, high pass at about 150Hz and low pass at about 2KHz or so
- Kicker subs: power 8-10, low pass at about 150Hz or so.

The system is predominantly front staged (driver and passenger, which is what I wanted) and just with enough fill from the back. Since I am only feeding limited spectrum to the subs, they of course have to get much more power to "balance" out with the rest of the system. Yes, there is a little multi-coverage on the low frequencies, but I adjusted the a/d/s crossovers until the system sounded good, seating in the front and the rear of the car. This part takes a while (since you have to go back and forth the trunk and the seats many times) but the results are worth it!

As for the sources from the head unit:

- front and rear channels use the OEM front signals, so the balance of front to rear is done at the amp since my amp has adjustable gain for each pair of channels.
- the subs use the OEM rear signals so this allows me to change the relative power going to the subs by simply using the FADER control on the OEM head unit.

NOTE: Some aftermarket amps (like my a/d/s) have a remote BASS adjustment that could have been used instead of the fader, but I wanted the stock look and did not want extra knobs in the front of the car.

Components/pieces that I used for the installation:

- 1) a/d/s P640 amp (6 channel x 40W, built-in crossover) = \$250 (used on Ebay)
- 2) a/d/s 345is Separate Component Speakers = \$245 (new, super deal on Ebay)
- 3) Kicker 6x9 Free Air Subs (now discontinued) = \$150 for the pair (new)
- 4) Peripheral Vendetta 4 = \$40 (new – search Internet for it)
- 5) Cable Ties, High-strength Velcro, labels, etc. = \$20-30 (Radio Shack)
- 6) Amp Installation Kit (ground, Power, and in-line fuse) = \$30 or so (but came free from the same guy who sold me the P640)
- 7) OEM CD install kit with new rear panel = \$100 or so with BMWCCA discount.

So I spend about \$850 on parts and since I did all of the installation (about 9-10 hours worth) myself I saved

It is VERY important to have a reference CD to compare your system before and after, especially if like me you are changing the main speakers. I made a new CD with different songs to test the system before and after, plus I took the same CD every time I went to listen to speakers – something has to remain constant so that you can really make comparisons!. Pick music from various sources (not just from one CD nor author) so that you can “really” test different aspects of your system. I have hard rock, rock, pop, classical, soft-rock, etc. on my CD so pick something you listen to. Just in case you are curious these are the songs on my “test CD”:

- Hybrid Theory - Linkin Park
- December - Collective Soul
- You Oughta Know - Alanis Morissette
- Call Me - Blondie
- Sunglasses at Night - Corey Hart
- Drops of Jupiter - Train
- Meet Virginia - Train
- Home - Sheryl Crow
- Hold On - Santana
- Don't Do Me Like That - Tom Petty & the Heartbreakers
- Refugee - Tom Petty & the Heartbreakers
- Time and Tide - Basia
- Last Chance - Shooting Star
- Brand New Day - Sting
- Love Theme from "The Saint" Soundtrack
- Devil Inside - INXS

The “new” system is completely unbelievable: clean, sharp, great bass and superb imaging. A couple of co-workers (one of them a jazz musician, another a guy with an M3 like mine but with “stock” H&K; stereo) have listened to the system and cannot believe how different and improved the music now sounds. It is like night and day – this is the way the H&K; should have sounded when we got it. The new system is so impressive (specially with CD's) that you can now listen to music louder and your ears do not hurt after a while, plus with the VEN4 there is absolutely ZERO hiss/noise when the engine is running.

#### Lessons learned:

- Research, and then do more research before you start. Look at the references I list below as a starting point. Those guys figured out what worked and what did not – lets leverage what they learned.
- YES, you can do the work yourself. As I will show you in the pictures below, there is a great deal of work involved to wire the amp to the OEM harness, but it is doable. Take your time – it pays.
- Make sure your amp can take the diff signals. I am exchanging email with another guy who tried without the VEN4 adapter and the noise was far too great once the engine was started that he had to shut down the radio. He is now in the process of buying the adapter.
- The H&K; system is adequate, but not even close to being decent (in my opinion, of course). You can spend “relatively” little money and get a really good upgrade.
- The OEM head unit is very good. Certainly not the best, but good enough for most all stereo upgrades. Plus, keeping it means that the steering wheel controls DO work after the update.
- NO, you do NOT need special, pricey, super-duper speaker wires. The OEM wires are more than adequate and are already twisted which minimizes noise pickup.
- Yes, you do lose the speed sensitive and “spatial” mode – and I am VERY happy I did J
- NO, getting the H&K; system upgrade hoping that will make upgrading easier later is not true (what was my hope and I was wrong). There is nothing in the H&K; system that makes the upgrade easier. The ONLY thing I am re-using is the H&K; sub housing, but to pay \$600 for that is insane!
- For those of you who like the H&K; but want extra bass, just get a 2 channel amp, the adapter (if needed), and drive your subs with it. You can also try to fit aftermarket 6x9's (the subs I got are now discontinued) and just use the built-in crossover to give the subs only the lowest frequencies (100-150Hz is a good place to start).
- It is worth to get a quality amp and quality separates – my system sounds awesome and it is because of the items that I selected. Even if you are on a budget (like I was), remember that you can replace stuff later, but it is cheaper to put good stuff the first time around!

OK, so here are the install pictures.

Getting access to the OEM amp:





[3 captures](#)

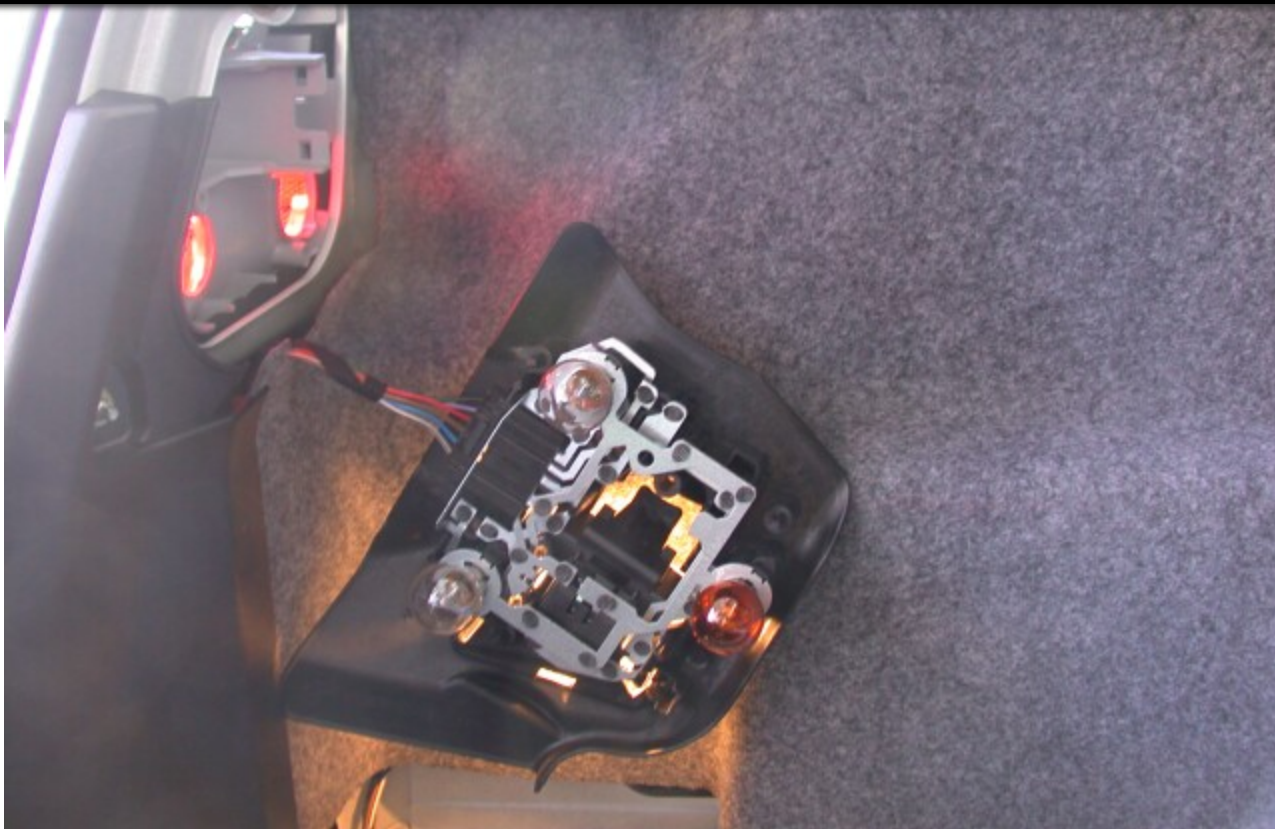
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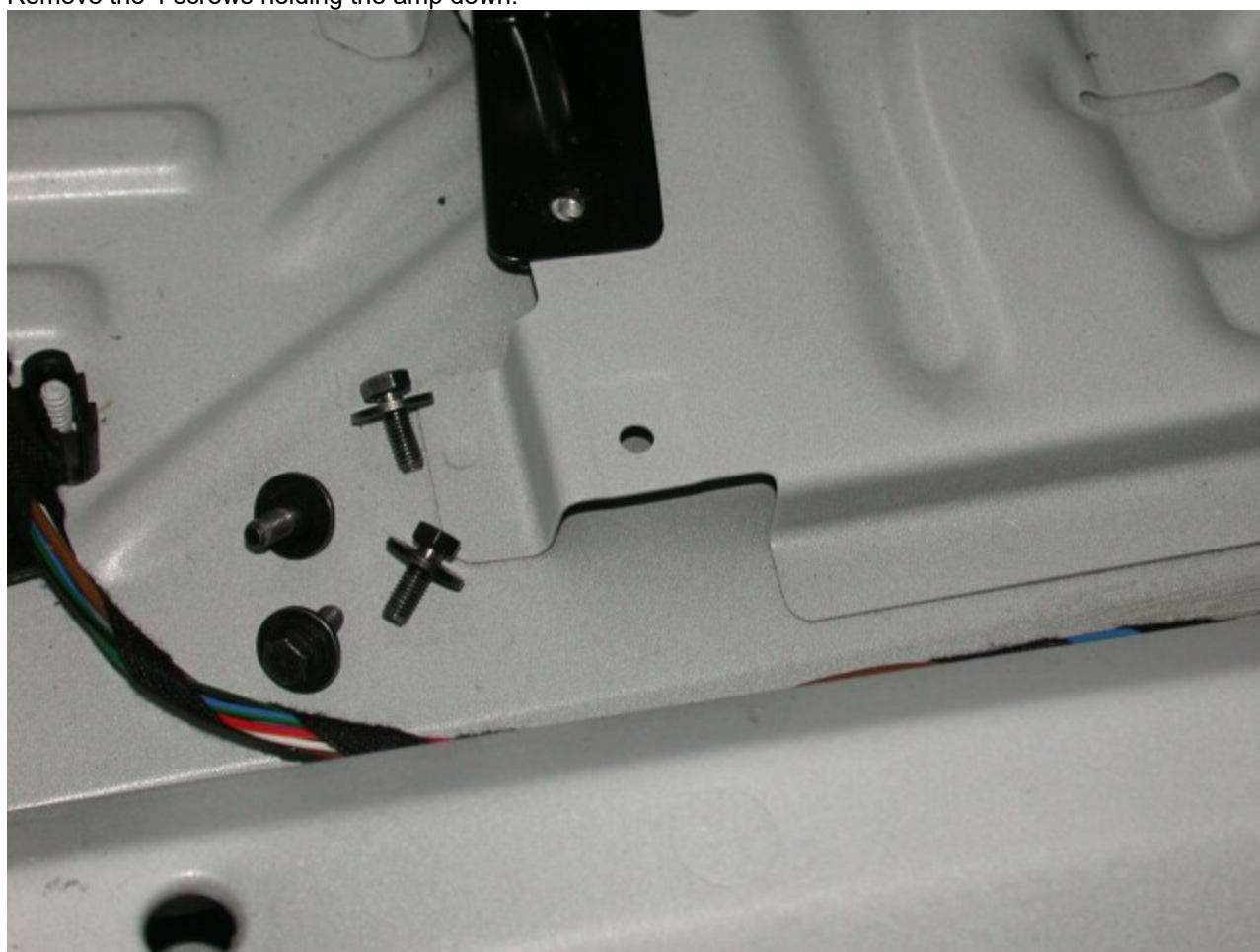
Look at how "tiny" is the OEM amp that is supposed to be driving 6 speakers in the front, and four in the back (not counting the 2 subs):



Push the small "square" within the connector to remove it:



Remove the 4 screws holding the amp down:



Remove the piece of [Oops!] OEM amp from your fine car!:





Look at how much bigger the a/d/s amp is, even though is going to drive fewer speakers:



Although this is not the final resting place for the a/d/s amp, this is where I put it while I tested the whole system:



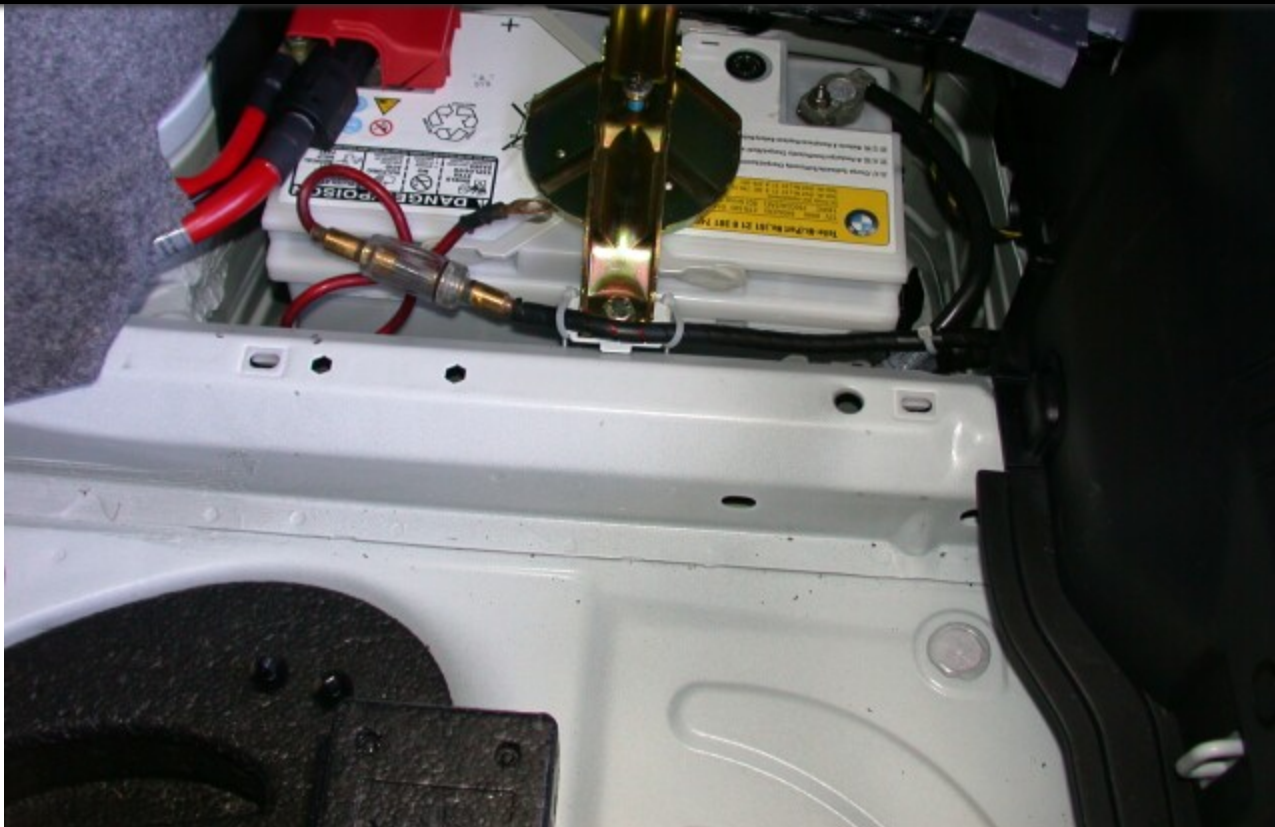
It is always best to find a ground VERY close to the amp, in this case, it if even better to use the SAME spot used by the stock system for ALL audio grounds:





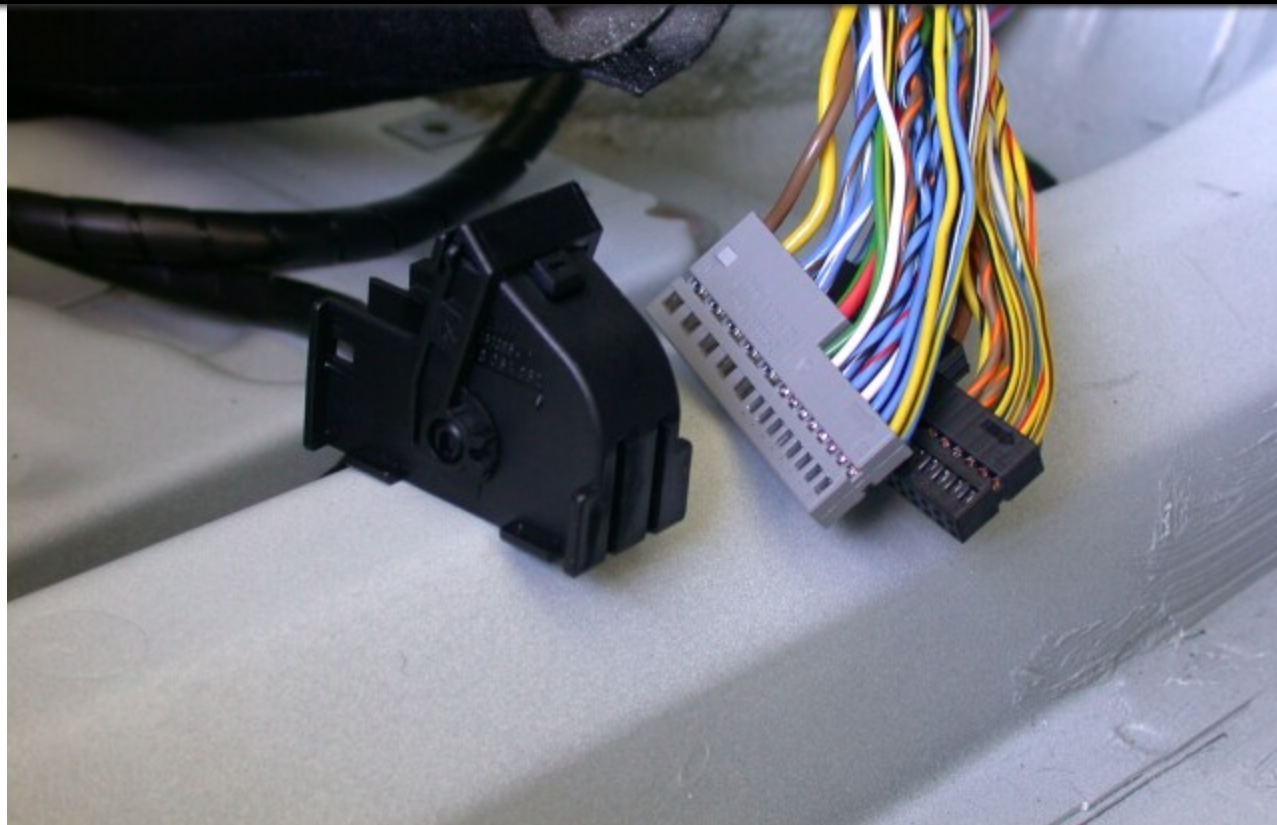
Of course, use heavy gage wire with an in-line fuse as close to the 12+ terminal as possible (notice I used cable ties everywhere – no room for accidents!):



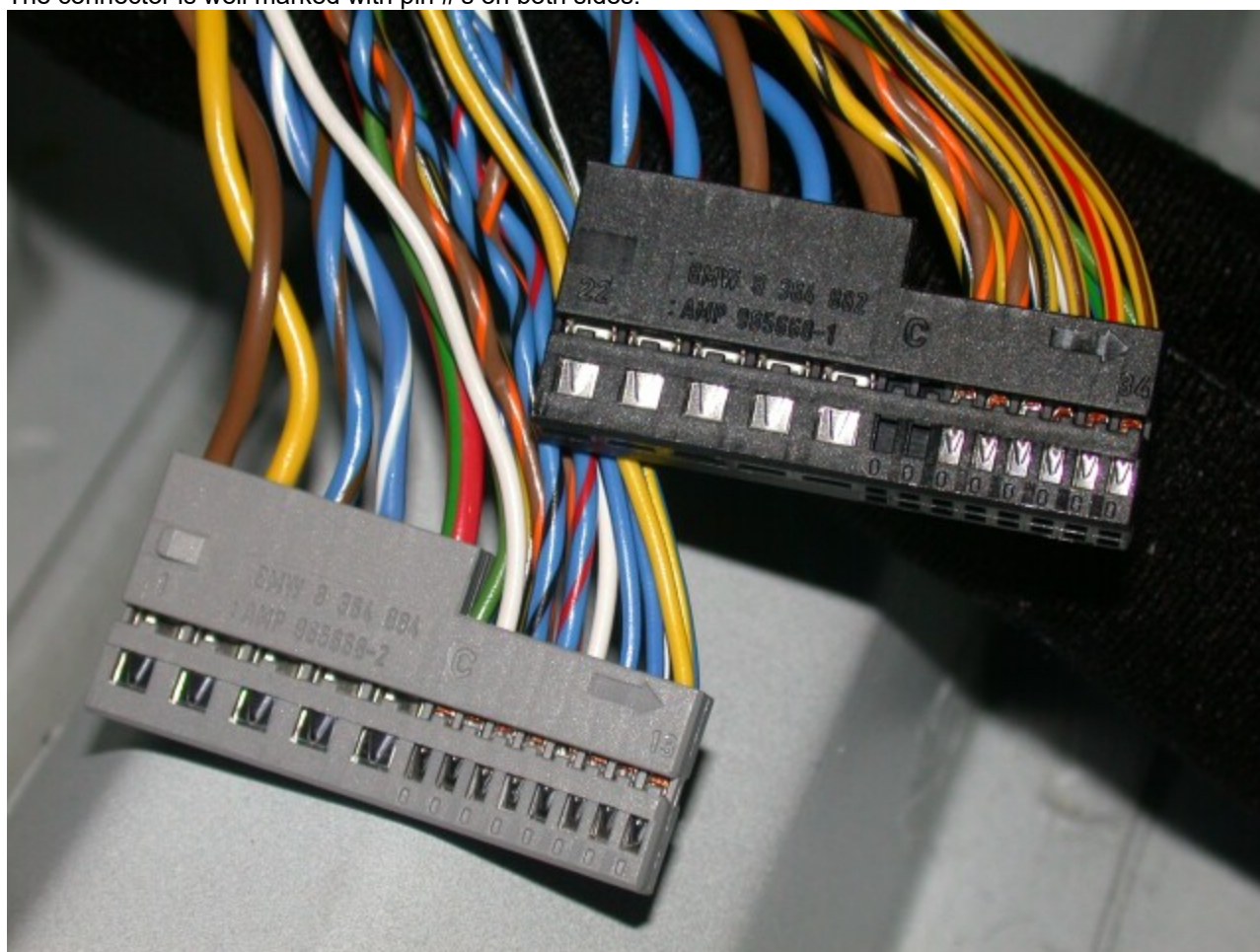


OK, this is now the hardest and most time consuming part (by far): to deal with this little devil over here, which is really two connectors inside one housing (just pull apart gently the black housing) :

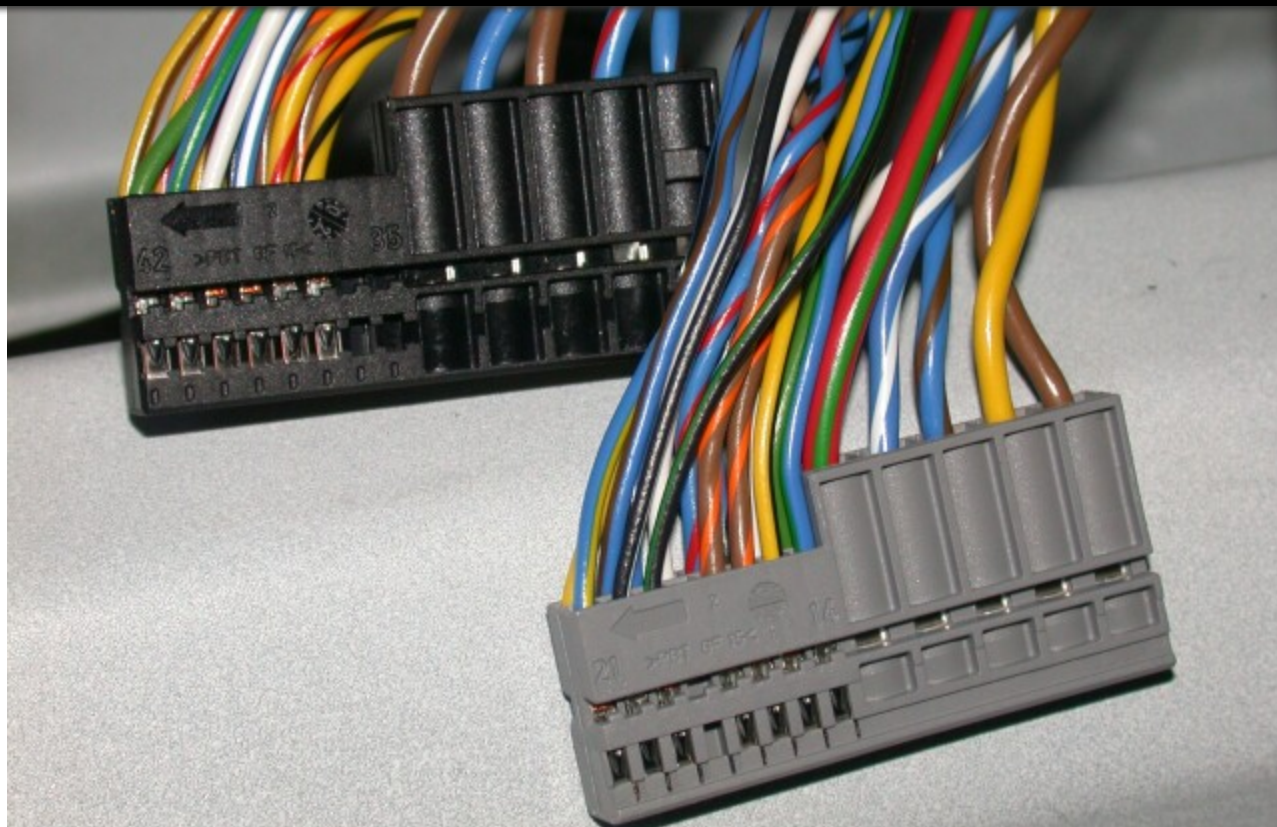




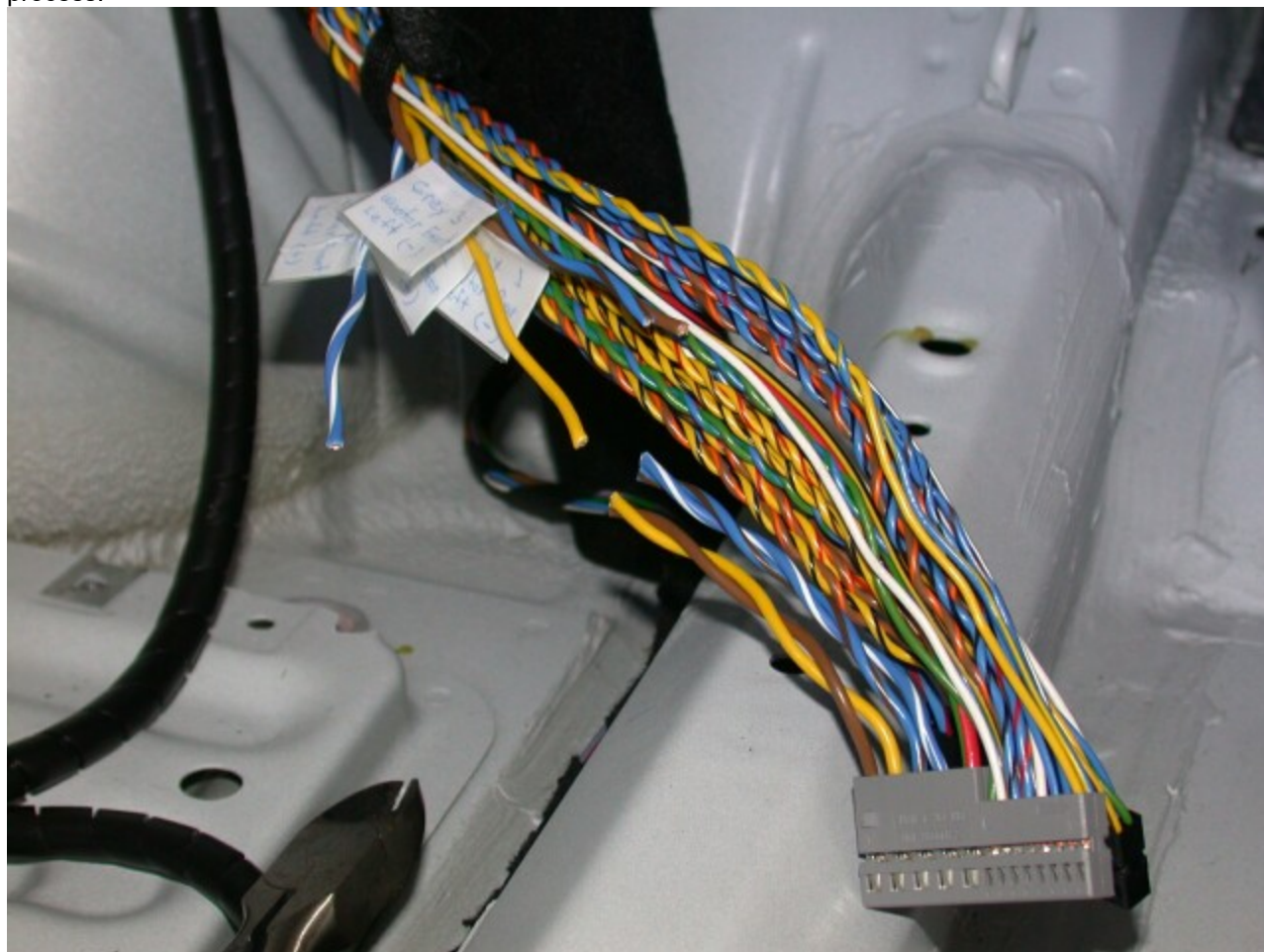
The connector is well marked with pin #'s on both sides:



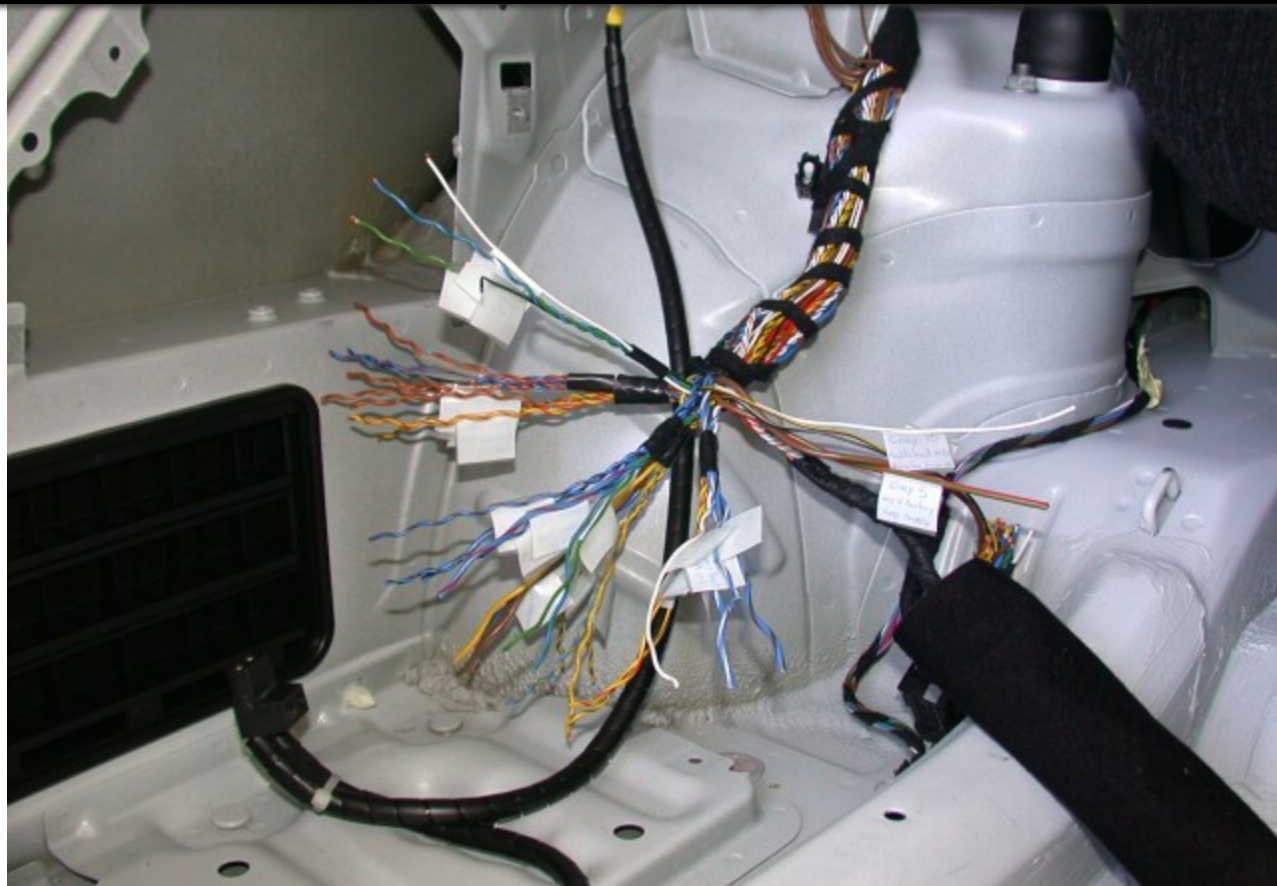




You can probably deal with this in many ways, but I decided to label every pin (with labels from Radio Shack) to make sure I knew where they came from in case I had to re-wire at any point (which I did). Many of the wires are the SAME color, so without labels you are in big trouble if you get confused. This seems (and it was) a lot of work, but my complete install worked the very first time with ZERO errors. Here is a picture of the labeling process:







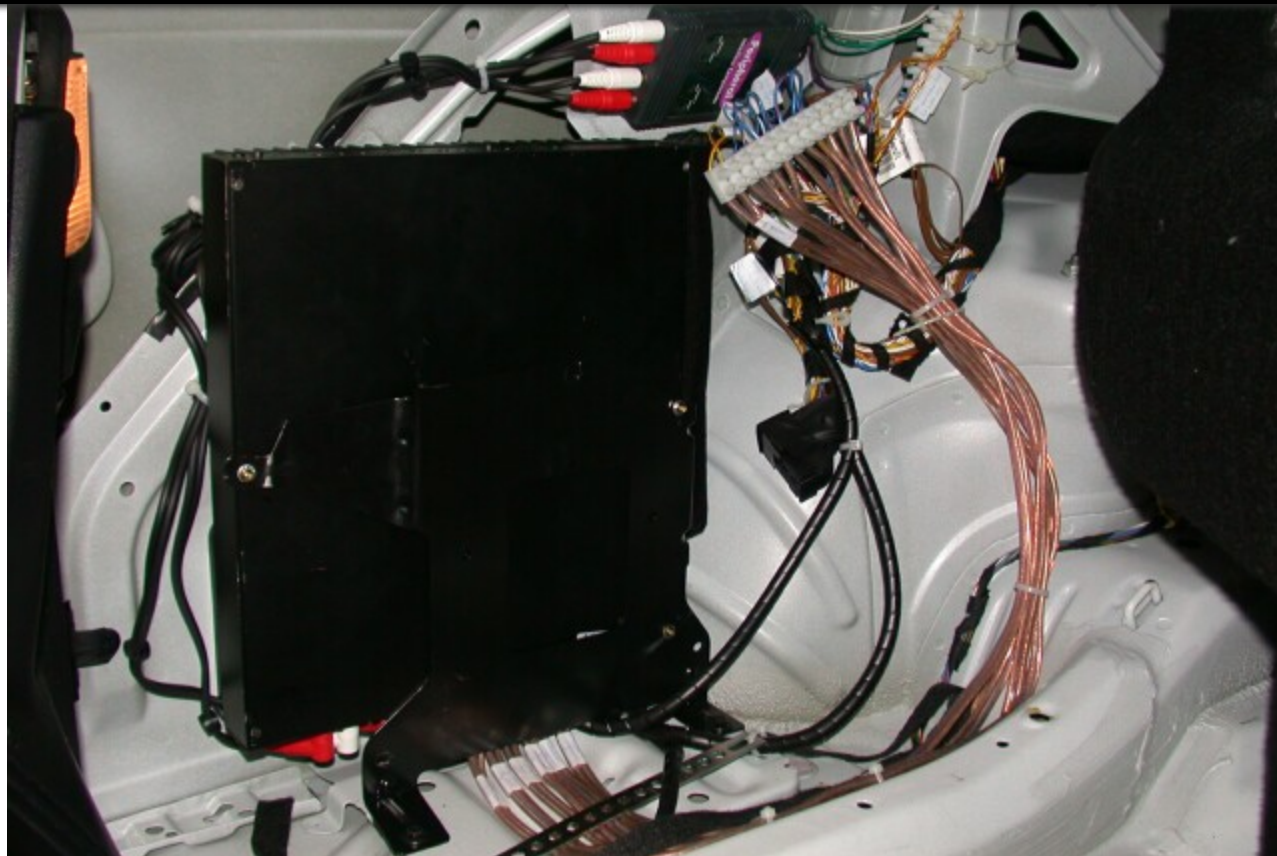
One tip is to group (with electrical tape) the channels as you go along. For example, group together the front speakers (left), the front speakers (right), and so on. If you know that you are not going to use some of the wires (like I did not use the front mids nor the rear tweeters) you can group those aside and out of the way.

Here is the Peripheral VEN4 being wired:



You probably noticed that I am using screw-type white posts to get signals together. Not only these are electrically strong, but allow me to re-wire as appropriate (which I did since I first wired the amp to the stock speakers, and then later to the external passive crossovers for the separate front components). Pick the right method to fit your needs.





The a/d/s amp has all adjustments and crossovers on one side (opposite to I/O signals) so it is very easy to adjust:



By the way, I used the a/d/s amp with the factory front woofer and tweeter and although it was a little bit



In these pictures the factory lining does not fit, but it covers the amp for now (I drove it for a week like this), until I replace it with the OEM CD-changer kit (with new panel) later on:





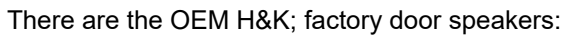
Here I now start with the front doors:





I have a link below (from [bmw330ci.com](http://bmw330ci.com)) that shows in detail how to get the panel off, so I am not going to post my pictures of that. Here is the door with the panel off:







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I started with the woofer:









Here is the new 345is "smaller" driver:





but that has the same overall depth:



I removed the bracket that holds the OEM woofer to the door panel:







And removed the ring which remains on the door panel, which is not being reused:









And here is the woofer (or mid) already installed:

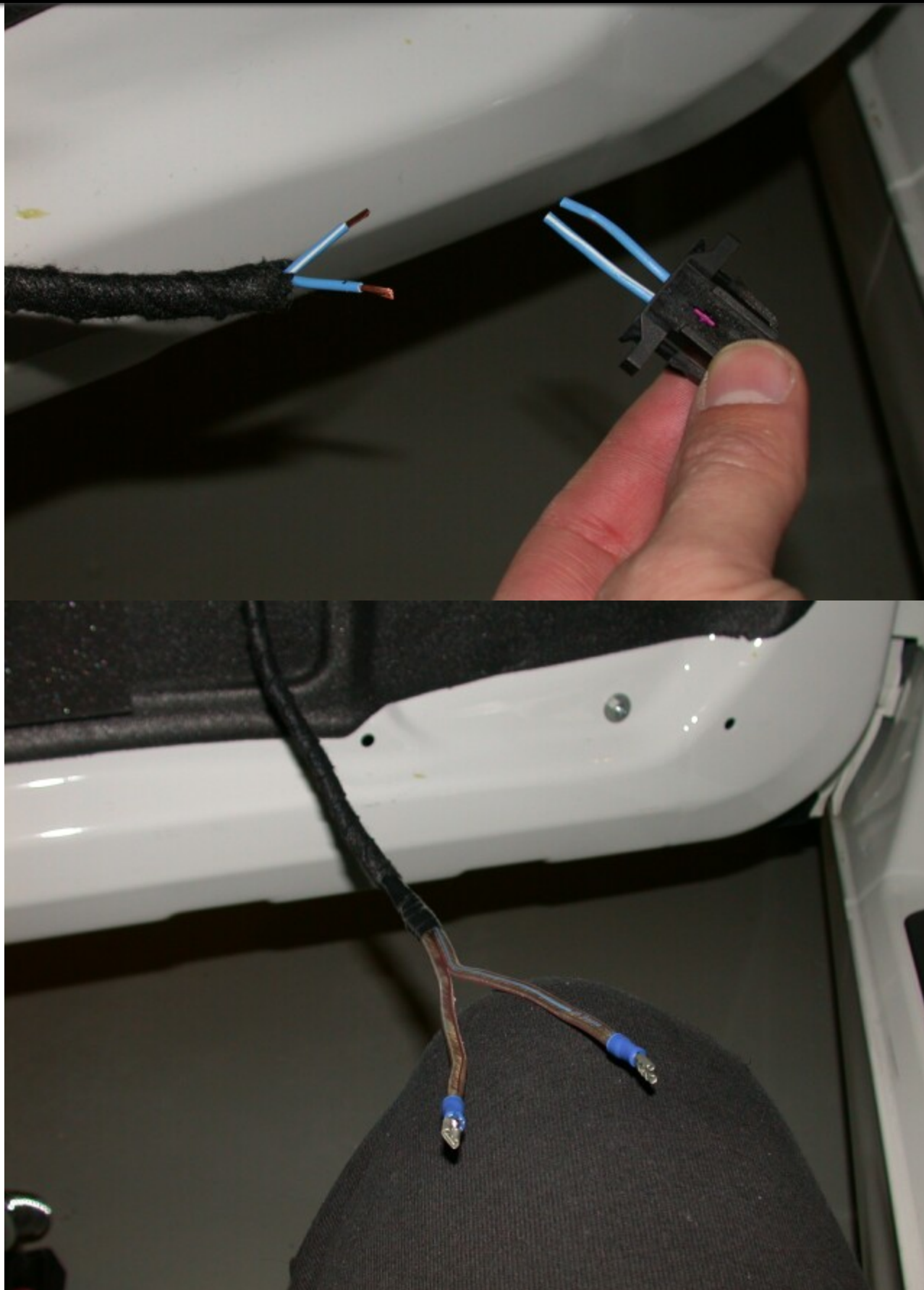


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I removed the factory connector for the woofer and solder new terminals for the new woofer:



So now, back to the OEM tweeter/mids:



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Hard to tell, but the tweeter is actually angled towards the driver a little bit:







also, note that the door panel itself is also slightly tilted towards the driver:



Not that you need to know this for this upgrade, but the only way to get the mesh out of the door panel is to remove the door panel and remove the tweeter/mid. It is just clipped in place:



Here is the new super-duper tweeter that will replace both the tweeter/mid:

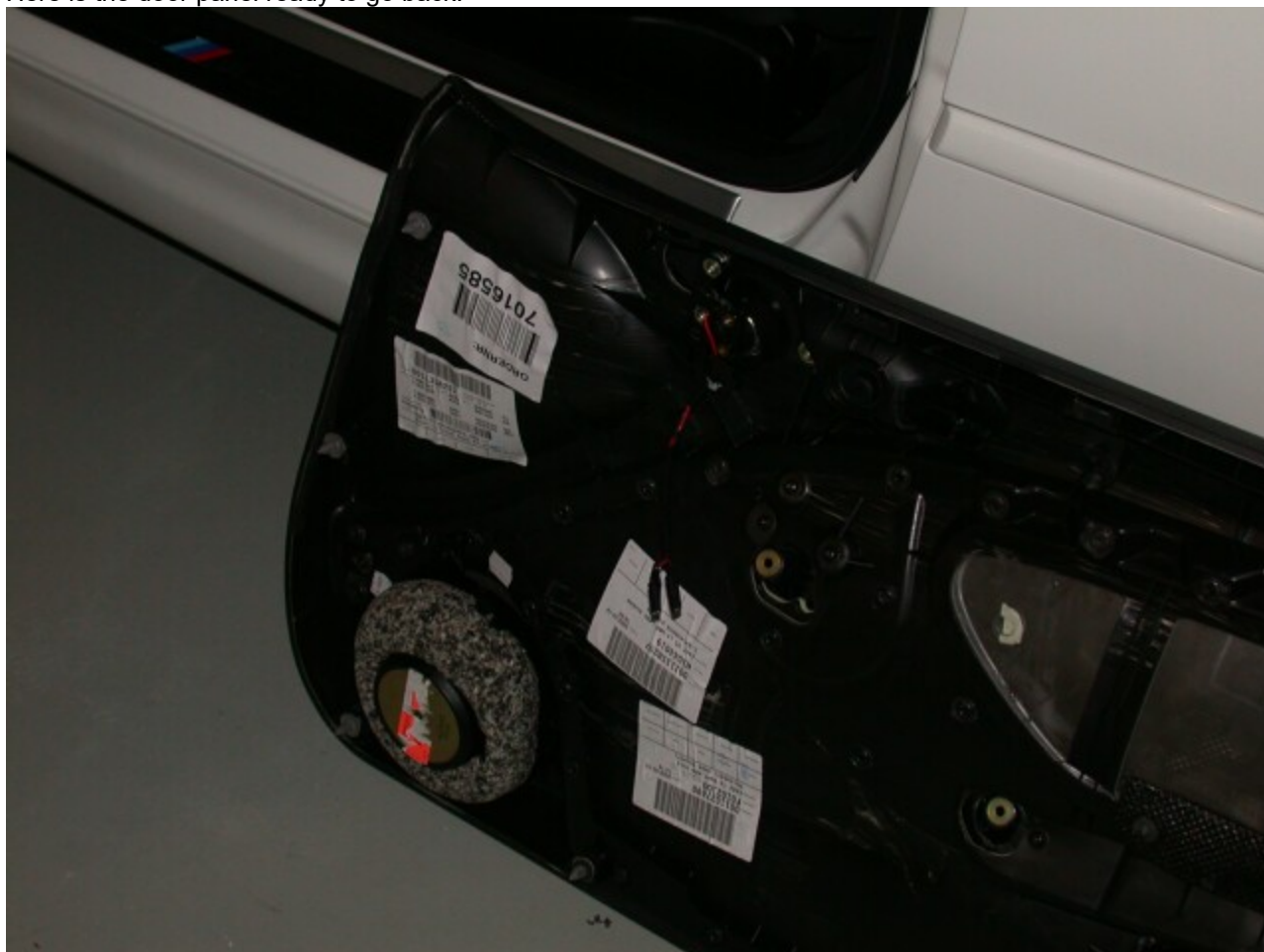


I made a small bracket for the a/d/s tweeter out of a piece of metal and attached it to the same spot the OEM units goes. Not pretty, but it works, it is solid, and it is also angled towards the driver:





Here is the door panel ready to go back:





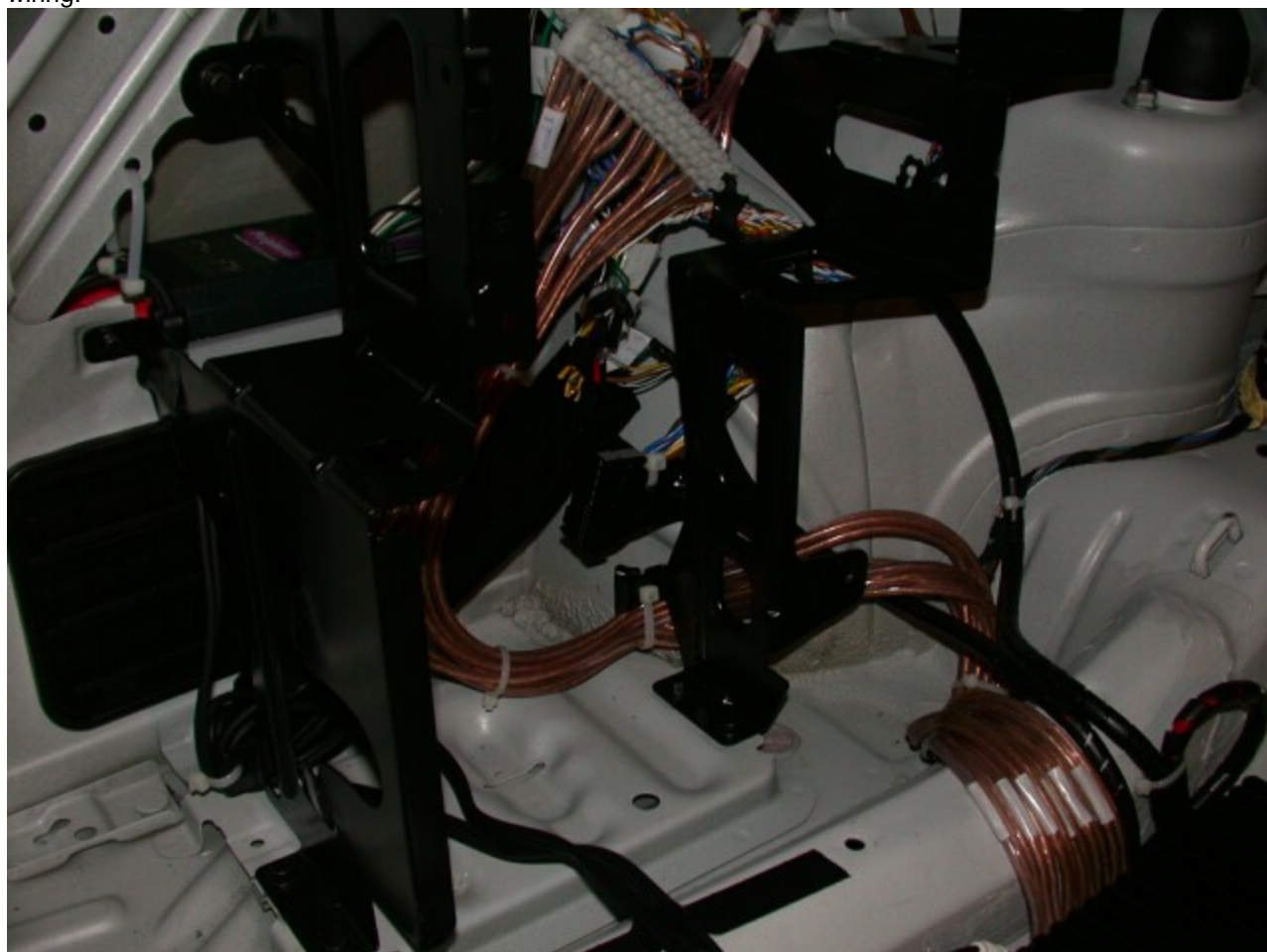
I did the right door next, and then went back to finish the amplifier/crossover installation. I did try the front speakers with the a/d/s amp but without their a/d/s speaker crossover units and the new a/d/s speakers did not sound good at all – I simply could not adjust the level and frequency balance to match the carefully developed a/d/s crossover, but at least I was able to verify that the speakers were wired properly.

So since I wanted to use the Alpine MP3-cable CD changer soon, I decided to go ahead and get the kit and re-locate the amp at the same time. I choose to locate the amp next to the "Mobility Kit" as shown here (notice that I already got the brackets for the CD changer in place:

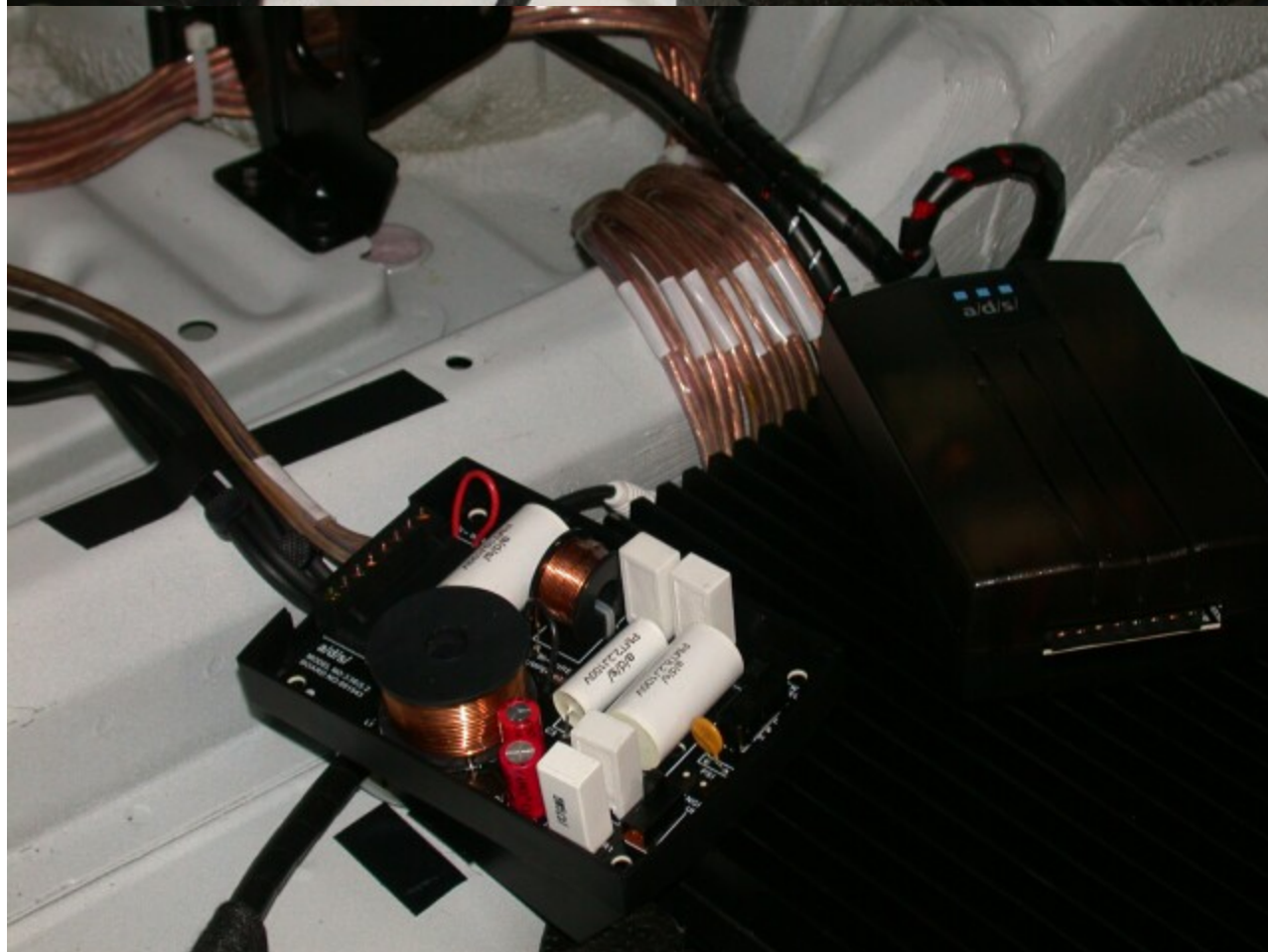




Since I am not using the OEM amp, I now have space behind the brackets which I can use the tie and hide the wiring:

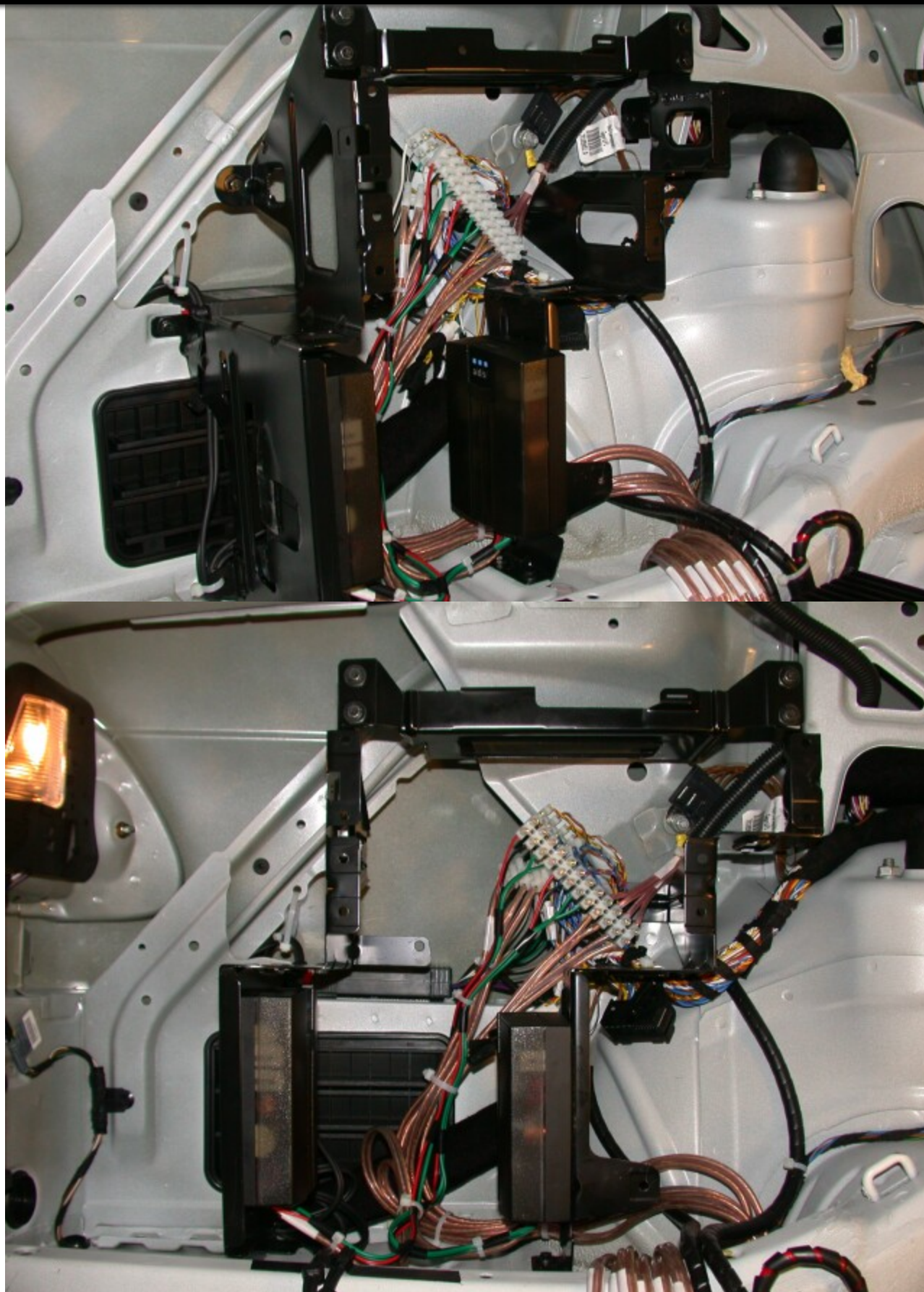


Here I am wiring the a/d/s front speaker crossovers:



Here I attached (with Velcro) the crossovers to the CD bracket:





And here I put everything back together:









Here are a few of the accessories that I used:



Here are the references that I used:

- <http://e46fanatics.com/faq/stereosaga.html>

Excellent and most helpful site – “correct” wiring diagrams and signal theory for BMW OEM amp. Notice that

Outstanding knowledge of BMW factory systems and a/d/s upgrades.

- <http://www.adst.com/pages/manuals.html>

Great guides for a/d/s upgrades for BMW's.

- <http://forums.roadfly.org/bmw/forums/e46m3/forum.php?postid=770237&page;=1>

Good information from Dom, who is collecting stuff to be added to the FAQ.

- <http://www.mindspring.com/~pmbenn/stereo.htm>

- <http://www.projectbimmer.com/>

Examples of installs on BMW's.

- [http://www.eskimo.com/~dalus/bmw/e46/stereo/e46\\_cd\\_changer\\_installation.html](http://www.eskimo.com/~dalus/bmw/e46/stereo/e46_cd_changer_installation.html)

Excellent post on how to install the Factory CD Changer Kit.

- [http://www.bmw330ci.com/DIY\\_Door\\_Panel Removal.htm](http://www.bmw330ci.com/DIY_Door_Panel Removal.htm)

Great link on how to remove the front door panels.

I know this was a very long post, but I hope that it will help others with their own upgrade plans.

William

12/01/02

Re-Print of David Badgy's wiring diagram for E46 cars taken from here (not added the H&K; signals as I did not use them):

<http://e46fanatics.com/faq/stereosaga.html>

Factory harness Wiring information:

Now that you have the connectors made, you need to figure out how to wire things up...

Some of the wiring harness info available on bimmer.org in the archives and the info faxed to me by ADS for the E46 is WRONG.

In the course of making the connector I started with info from the bimmer.org archives and a faxed page of info from ADS re E46 wiring – both had (different) errors in them – be advised that it pays to check all wiring for yourself in a project like this. Both sources had incorrect pin numbers and colors that did not match the wires physically in the harness. I have provided (to the best of my knowledge) corrected information below.

The notation I used below is:

Pin # xx / Signal

(main wire color) / (wire stripe color)

no connection literally means that there is not a wire in the factory harness at that pin.

Signal name followed by an \* are signals that I believe to be correct, the color code is verified with the harness etc, but I did not personally use these signals in the upgrade so I can not claim to have proven the connections out personally. In particular I did not verify the +/- polarity of the factory mid range speakers. The non-\* signals lines I am using to run the upgraded system so I am sure they are correct (at least for my car).

The harness connector pin numbers are embossed on the plastic. There are two "halves" to the connector, looking at the female harness connector its pin lay out looks like this:

Grey ½ of connector

Pin # 13 / Tweeter Rear Right door + \* Yellow Pin # 21 / Tweeter Rear Right door - \*Blue / yellow

Pin # 12 / Tweeter Front Right - Blue / Brown Pin #20 / no connection

Pin # 11 / Tweeter Front Right + Blue / black Pin #19 / no connection

Pin # 10 / Switched +12v remote turn on White Pin #18 / no connection

Pin # 9 / Head unit output Front Right + Blue / red Pin #17 / Head unit output Front Right - Brown / orange

Pin # 8 / Head unit output Rear Right + Blue / black Pin #16 / Head unit output Rear Right - Brown / orange

Pin # 7 / no connection Pin #15 / no connection

Pin # 6 / no connection Pin #14 / no connection

Pin # 5 / +12V factory amp +12v supply \*Red / green



Black ½ of connector

Pin # 34 / Tweeter Front Left - Yellow / brown Pin # 42 / Mid Front Right door + \*Green

Pin # 33 / Tweeter Front Left + Yellow / red Pin #41 / Mid Front Right door - \*Blue / green

Pin # 32 / Tweeter Rear left door - \* Yellow / brown Pin #40 / Mid Front left door + \*White

Pin # 31 / Tweeter Rear Left door + \* Yellow / black Pin #39 / Mid Front left door - \*Blue / white

Pin # 30 / Head output Front left - Brown / orange Pin #38 / Head output Front Left + Yellow / red

Pin # 29 / Head output Rear Left - Brown / orange Pin #37 / Head output Rear Left + Yellow / black

Pin # 28 / no connection Pin #36 / no connection

Pin # 27 / no connection Pin #35 / no connection

Pin # 26 / DC ground factory ampBrown

Pin # 25 / Woofer Rear Right +Blue

Pin # 24 / Woofer Rear Right -Brown

Pin # 23 / Woofer Front Right +Blue / Red

Pin # 22 / Woofer Front Right -Blue / Brown









Pins 1-5 and 22-26 are heavier connections that then other pins, these are the ones that feed the woofers and provide power to the factory amp. I did not use the power connections for the factory amp for the ADS amp – the ADS can draw 30A and the factory connector had wire much too small for that type of current draw. Instead I powered the ADS amp directly (with safety fuses etc) from the battery (easy since BMW puts the battery in the trunk).

William

Richardson, Texas

2002 Alpine White/Black Leather/SMG

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