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How to: In-Wall Wiring for Your Home Theater

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08-21-07, 04:05 PM #1

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My Photos

How to: In-Wall Wiring for Your Home Theater

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How to: In-Wall Wiring for your Home Theater

Part 1: Instructions for Dropping Wiring In-Wall From an Attic

A few years ago I visited an old friend for the first time in a many years and couldn't help but notice how poorly her home theater system was set up. The worst part was the speaker wires hanging on the wall between the receiver and the rear speakers. Yes, *hanging!* I timorously asked her, "Um, do you *like* having those wires draped across the wall like that?" She replied with a blank expression, "Do I have a choice?"

The answer, of course, is a resounding, *"Yes!"*

Certainly no one likes to see speaker wires hanging on the walls or strung out across the floor. However, one of the biggest challenges in setting up a home theater can be getting the wire to the back of the room for the rear speakers, especially if your house is pre-existing (as opposed to new construction). But if you have an attic (or crawl space) big enough to move around in, it's not terribly hard to run your rear speaker wires in-wall and get a clean appearance in your room. This is the first in a series of articles providing a step-by-step on how to accomplish retro-wiring not only for rear speakers, but any kind of cabling inside the walls you might need for your home theater.

First, let's take a look at the tools and supplies we'll need. Naturally, there are a lot of pricey specialty tools that professionals use, but I don't expect the weekend installer will want to drop $100 or more on exotic devices that he might use once every 5-10 years. As such, some of the "tools" are items we'll "manufacture" that can hopefully accomplish the same thing.

Tools

- **Metal coat-hangers.** Preferable one for each location where you'll drop a wire, hooks cut off, straightened, and bent into an "L".
- **An appropriate pull string.** I recommend a 12-ft. length of weed eater line. Light-duty .065 line works fine. (If your ceilings or taller than 8 ft., add 4 ft. of weed eater line to the ceiling height.)
- **A short 1-ft. length of light-duty chain.** You can find something appropriate on the hardware aisle at most hardware stores, something used for hanging planter baskets, etc. The chain should be a ferrous metal. We'll show a picture of a fully prepared pull string /chain later.

- **#2 Phillips screw driver.**
- **A pair of pliers.**
- **Pencil.**
- **Electrical tape.**
- **Extension cord.**
- **Assorted drill bits.**
- **Electric drill.** I suggest a heavy-duty model with a 1/2" chuck and side-handle, to better wrangle the aggressive auger bits we'll be using.
- **A couple of 1" x 12" boards** about 3 ft. long. Optional, but highly recommended.
- **Drywall saw.**

- **Three-way electrical tap.**

- **A small "torpedo" level.**

- **An electronic stud finder** never hurts.

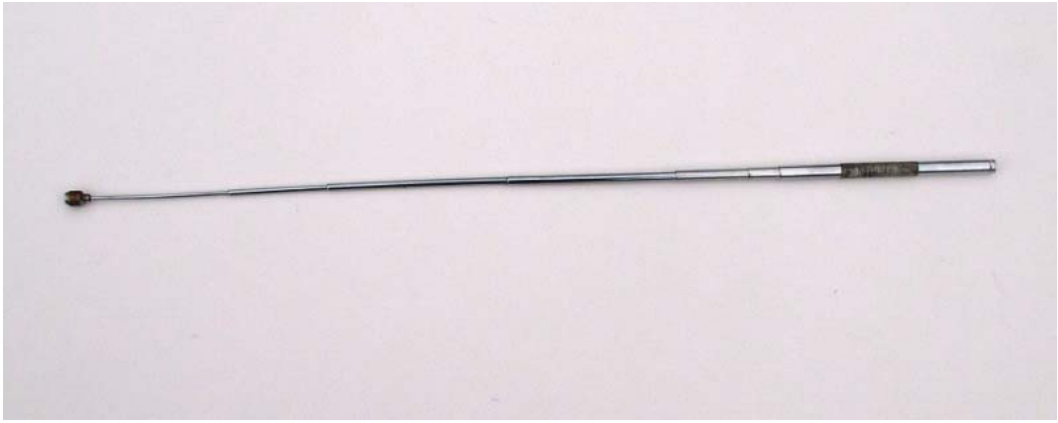
- **Work light with built-in clamp.**

- **3/4" auger bit.** Preferred over a similarly-sized paddle bit. Augers (also called wood-boring bits) are much more aggressive than paddle bits. Plus they cut faster and last infinitely longer.

- **18" drill bit.** Something in the 1/4 - 3/8" range. Typically not needed for attic wiring, but folks running their wiring through crawl spaces will need this. Alternately, an 18" drill extension will work, but they are more expensive than a long drill bit.

- **8" Side cutters.**

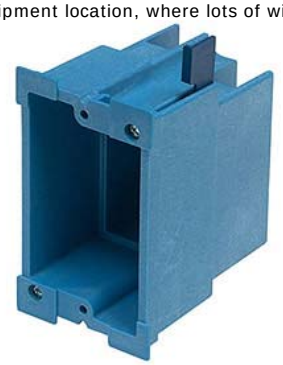
- **A telescoping magnet "antenna."** Commonly available at auto parts stores.



- **A spool rack (a.k.a cable caddy)** is handy. If not, a piece of 1/2" conduit pipe between a couple of chairs will work.

Supplies

- **Appropriate cabling.** All wiring should be rated for in-wall installation.
- **Three old work electrical boxes** (or more as needed for 6.1 or 7.1 installations). These may be considered optional if you intend to bring your cabling straight out of the wall, although I would strongly recommend one at least for the equipment location, where lots of wires will be coming in.



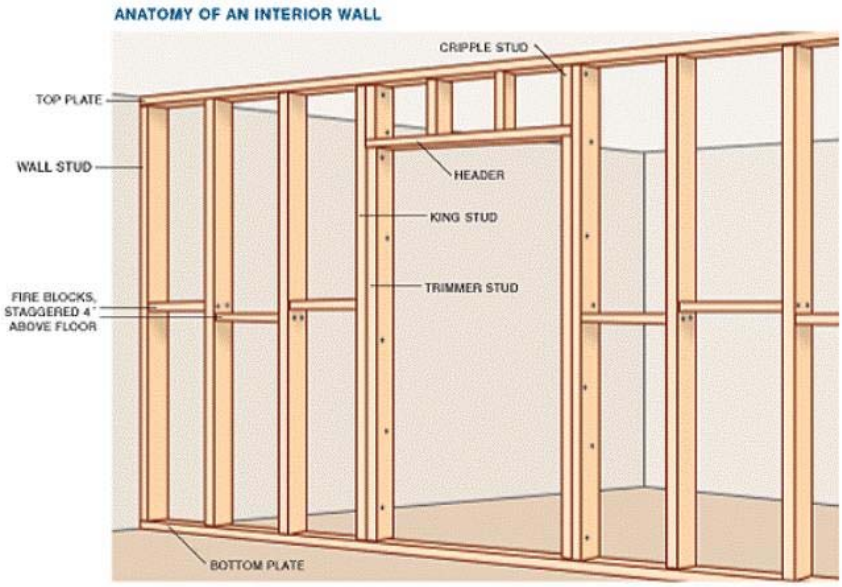
If you're pulling in a lot of wiring to the equipment location, like coax for antenna or satellite receivers, telephone line for the same, wiring for second- or third-zones, etc. you might want to use a double-gang old work box instead.

- **Covers of your choice** for the old-work boxes – more on that at the end of Part 1.

Getting started: Checking for obstructions in the wall and attic

To begin, it's helpful to know how an interior wall is constructed.

As you can see from the picture below, there really isn't much to a wall. Just some upright 2" x 4" studs all held together by a top plate and a bottom plate. (For the purpose of this discussion we're not interested in the doorway.) Don't let the presence of those fire blocks (or cross braces) worry you – if you have standard-height 8' walls, you probably won't have to deal with them at all.



Most likely you already have some idea where you want your equipment rack and speakers located. Naturally, you want the wire coming out of the wall directly behind the rack and each speaker so it won't be seen (in my opinion, "no visible wiring" is one of the hallmarks of a first-class installation). But before we lock down those locations we need to make sure they are viable from an installation standpoint.

Certainly, this job will be much easier if your locations are all on interior walls. Outside walls can be problematic. If an outside wall where you want to drop a cable has a low-sloping roof above it, you're probably out of luck, as you need at least 18" or so of clearance above the top plate. If you have a gable or high-sloping roof, it can be done, although there will be in-wall insulation to deal with (see Part 5).

Even with interior walls, you need to make sure there are no in-wall obstructions that would prevent the wiring from dropping through all the way down to standard electrical outlet height, or to the speaker height. You also need to make sure there is nothing directly overhead in the attic blocking access to the place you want drop in the wiring.

So, use the stud finder to make sure your proposed locations are between studs, and that there are no horizontal braces in the wall, like what you see in the picture above. It will be more difficult to drop a wire down the wall if there is a cross brace, but never fear - we'll discuss that later in Part 2. If the house has 8 ft. ceilings, there are typically no cross braces, but late-model homes with 9-10 ft. ceilings may use them (especially the latter).

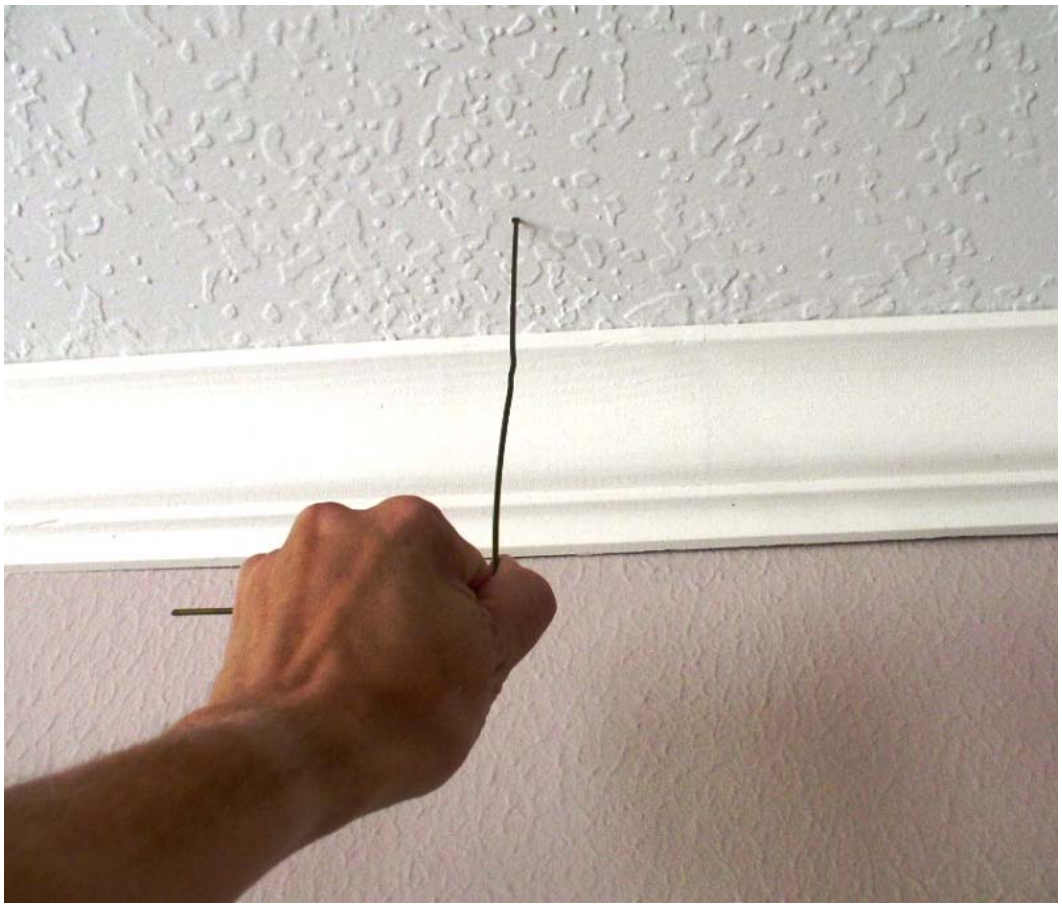
(NOTE: I've had trouble with my stud finder being fooled by seams in the wall when sheetrock was applied horizontally - probably because the wall has a different density where the joint compound is. Since sheetrock is 4' x 8', horizontal seams will shows up at 48" from either the floor or ceiling [at least with 8-ft. ceilings]. The way to tell if it's a sheetrock seam is that it will appear at *exactly* the 48-inch height for the length of the wall. True cross braces will have staggered, not consistent placement, as the picture above shows,

and will vary from 48" an inch or two.)

After determining there are no obstructions in-wall, we need to check for obstructions in the attic. The coat hanger(s) will do that for us, as well as help us find our drop locations once we get in the attic. We'll use the side cutters and pliers to prepare the coat hanger. Cut the hook off with the cutters and use the pliers to fully straighten it out; it's important to keep as much length as possible. Once the wire is straight, bend a 90° angle on one end, so that it looks like a capital "L." Use the side cutters to cut the tip of the long side at a sharp angle or point.

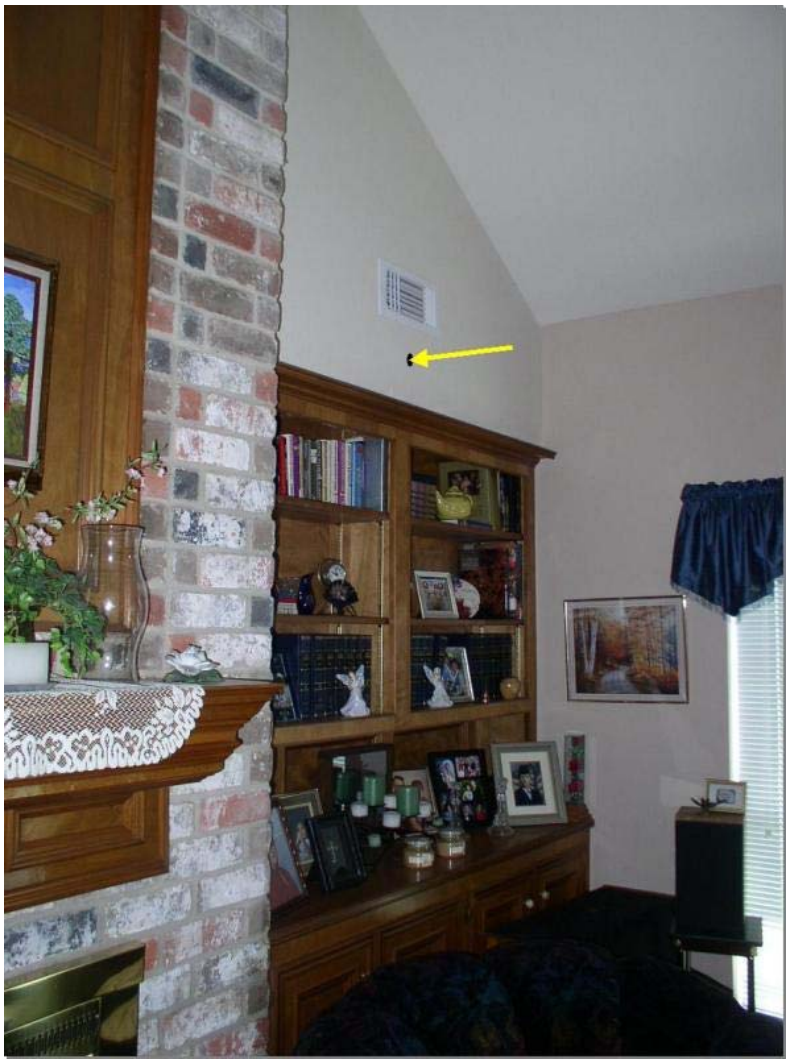
Next, drill a tiny pilot hole in the ceiling directly above each proposed drop location, a couple of inches out from the wall. Use a drill bit that's a little smaller in diameter than the coat hanger. The bit should drill through the ceiling easily – if you hit something solid above it, move out a couple of inches and try again.

After you drill your pilot hole, stab the coat hanger up through it. The coat hanger should go right up into the ceiling with no problem. If it hits something, there is an obstruction in the attic – which means you may have a problem! We'll take a look at that situation, and what to do about it, in a moment.



Our next step will be going into the attic to locate the coat hangers. The smaller-diameter hole we drilled in the ceiling will make sure the coat hanger will stay in place and not fall back to the floor.

It should be noted here that cathedral ceilings with attic space behind them require a slightly different tact. In this case, pick a point up on the wall that you are sure will access the attic. Drill the pilot hole and stab the coat hanger *horizontally* through the wall and into the attic, like so:



Find your drop locations in the attic

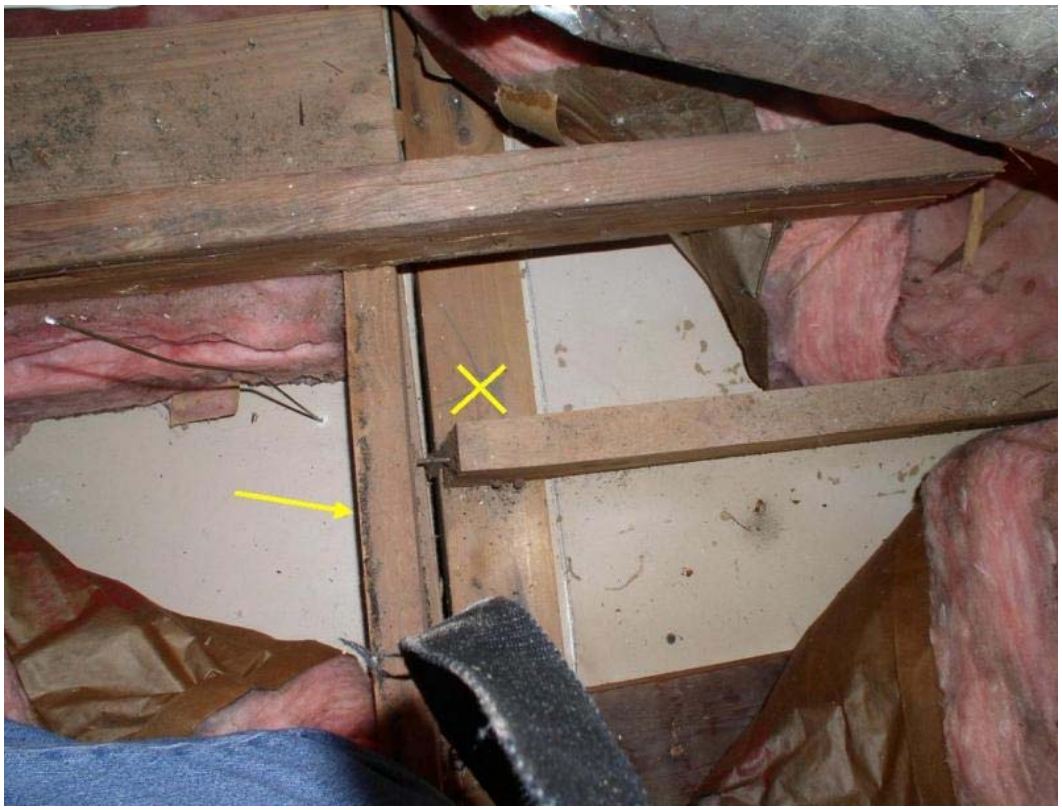
Next, go to the attic with your flashlight and find your coat hangers, and verify that all potential drop locations are viable. Now, if you have a really large attic it can be a problem figuring out which room you are over. So before you go up, it helps to note your coat hanger in reference to an air conditioning vent in the room. Once you find the room's AC duct in the attic, and then you know about where to look for your coat hanger. (It should be evident at this point why I recommended a coat hanger for each location – saves you from making so many trips in and out of the attic. This way you can locate all proposed drop points with one trip up there.)

The worst that can happen is for one of your locations to be directly under a water heater, AC duct or worse case, the air conditioner unit itself. Locations with cramped access, like those low-sloping roofs I mentioned before, are also a problem. You need enough room to position your drill and auger bit above the wall's top plate – which translates to about 18" of clearance.

Notice we did all this *before* cutting or any holes downstairs. Smart, huh? ☺ It would be a real bummer to cut a hole in the wall only to find out you couldn't make a drop there for some reason.

Okay – let's go up into *my* attic so you can see some of this first-hand. Sure enough, there's the coat hanger wire we poked up through the ceiling. That's where we'll be drilling a hole through the top plate of the wall:

When you find the coat hanger, pull back the insulation and you will see a horizontal 2" x 4" board next to it. This is the top plate for the wall, and drilling through it will put you inside the wall. In this picture, "x" marks the spot where we will be drilling, directly perpendicular to the coat hanger.

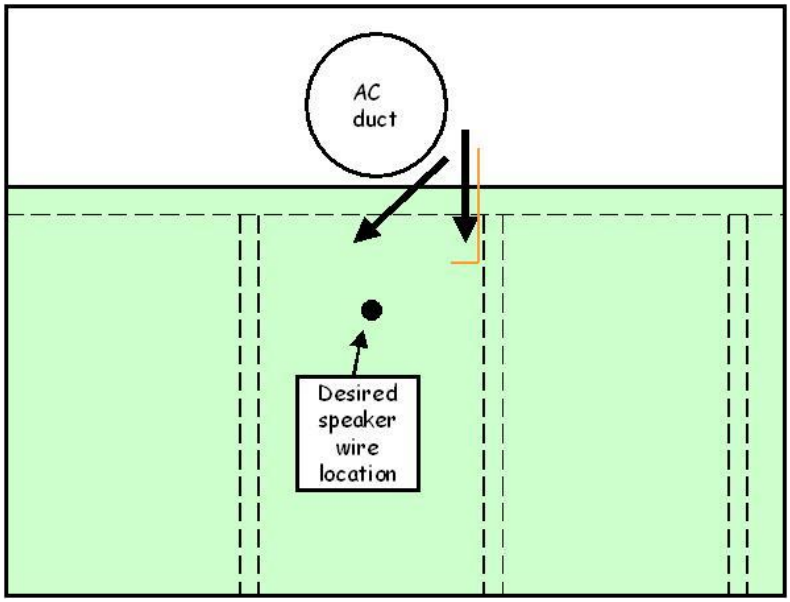


Note the arrow - this is a *vertical* 2" x 4" located right next to the horizontal top plate. Occasionally you will find stuff like this. The only significance for us would be if we had hit it when we drilled our pilot hole for the coat hanger. That's why I noted, if you hit something move out a few inches and drill again.

Don't forget, if you happen to be dealing with a cathedral ceiling, you'll be looking for your coat hanger wire sticking horizontally out of the "wall."

Now, let's back up a second and take another look at that picture of the coat hanger wire sticking up through the insulation. As you can see, just a foot or two over to the left and we would have been right under an air conditioning duct. That would have required a re-adjustment – either relocating the speaker over a bit (probably undesirable), or checking where the coat hanger is positioned in relation to the wall studs. Wall studs commonly sit on either 12", 16" or 18" centers, so in the event of an obstruction like this it may be possible to move your hole in the top plate hole over a foot or so and still be between the same pair of studs. If you can get the wire in the wall between the same pair of studs, you can retain your desired speaker location. Another remedy that might help stay inside the studs would be drilling into the top plate at an angle, to get the hole underneath the duct for a closer alignment with the coat hanger (which designates the precise drop location). Either way, you would have to go back downstairs and use your stud finder to locate the stud and re-stab the coat hanger up into the ceiling again. Back in the attic, you could then see the coat hanger as the "out of bounds" marker to stay between the desired pair of studs.

Here's a crude drawing that will help illustrate. The dashed lines are the studs and top plate. The orange "L" is the coat hanger that has been re-located to show us where the edge of the stud is. Drilling perpendicular will probably require the use of an old-work electrical box at the speaker location, so you can reach in the wall to grab the wire (that's not dropping in directly above the hole). Drilling at an angle, to better align with the point you want the wire to come out of the wall through a small hole, would be the preferred method if you don't want to use an old work box (more details on all of this to come). But basically the idea is to get the wire in the wall anywhere between the studs where the speaker will be.



Okay, once we've determined that all our potential locations are viable, we can go back downstairs and continue preparations. Maybe stop first for a cold brew... You're probably seeing already that home theater installation is not the glamorous work you thought it was!

Finish in-room preparations

At the equipment location you will probably want to install an old-work electrical box. If you're pulling in a lot of cable to the equipment location (and usually you are), you may want to opt for a double-gang box instead of a single - although I've been able to get an sizable number of cables in a single gang box, utilizing all four access holes. At the speaker locations you might want to use old-work boxes as well. If nothing else, it's easier to get the wire out of the wall through a large hole. Another alternative that's a little trickier is to bring the speaker wire straight out of the wall through a small hole – we'll discuss that option towards the end of this article.

You will use the drywall (a.k.a. sheetrock) saw to cut holes for the old-work boxes. The boxes should come with a pattern card that you can use to draw an outline on the wall. If there is no pattern available, you can make one by tracing around the old work box on a piece or paper or even better, card stock (like a shoe box lid). If you make your own pattern, make sure and exclude the box's flange! Otherwise your box will fall right through the oversized hole you'll cut.

Place the pattern on the wall, at standard electrical outlet height (take a baseboard-to-center measurement of a nearby outlet). Use your torpedo level to make sure it's straight, and trace around it. This is visually the most critical part of the job, so **don't screw this up**. If your box ends up crooked it will look bad, especially if your speakers won't be directly in front to hide it. So *be sure* and use your level on the pattern; *do not* try to eye-ball it!

The box should be a fairly snug fit in the wall - don't get the hole too large. Here is a page with illustrated details on installing an old work box that you might find helpful. I recommend using a hand-held screwdriver to snug up the tabs instead of the cordless drill, however. Also, the boxes have changed some since this page was put up, so that the top of the pattern no longer needs to be zig-zagged. Here's a cross-section picture of an installed box:

Don't install the boxes yet – we still have to drop in the wires! Just get the holes cut for now, at all locations before going to the attic.

Continued below...

Rules

08-21-07, 04:32 PM #2

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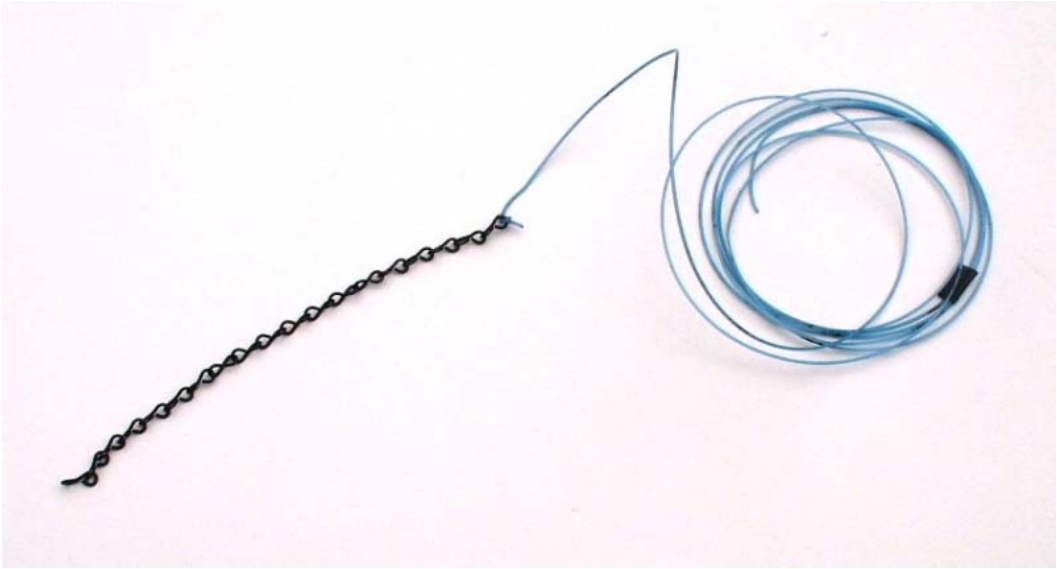
How to: In-Wall Wiring for Your Home Theater

Prep the pull string and wiring

Before we go to back up to the attic, we have to properly prepare our pull string and bundle of cables. So, first prep the pull string by tying one end to the small chain. The chain primarily serves to weight the string, so it will easily drop into the wall. Without the chain, the line will curl up and not drop very far into the wall. Even if you use some other kind of pull string besides weed-eater line, like electrician's jet line, it's still a good idea to have the chain attached. It has other uses as well, as we shall see.



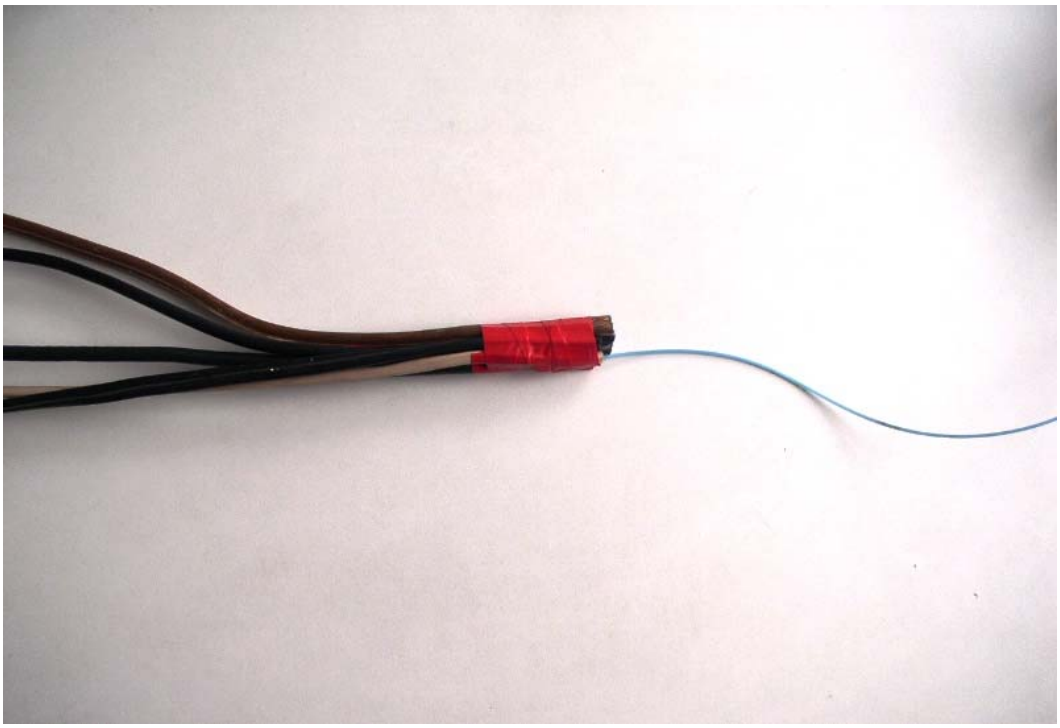
With the pull string / chain assembled we can ready our speaker wire, and any other wire that might be dropped at the equipment location – coaxial and telephone for satellite, wiring for second zones, etc.

If your situation allows, measure, spool off, and cut each cable the entire length it needs to be to reach from points A to B. Allow

extra length for any obstacles in the attic you might have to go around. Don't forget to allow for the length that will be inside the walls at both ends, and also include the amount of slack you want coming out of the wall at each location – especially at the equipment rack. After that, I typically add another few feet, for any "oops" factor. Until someone invents a wire stretcher, better too long than too short.

One of the tricks to a successful wire pull is proper preparation of the bundle of cables and securing them all to the pull string. If you don't do this correctly you're asking for trouble in some – if not most – situations. If the bundle hangs up on something while you're pulling it through the attic, you'll have to give the pull string a sharp tug to break it free. You don't want the pull string to break loose and leave all the cables behind – voice of experience here. Or, find out later than some of the individual wires broke free and were left behind. Thus, properly secure the pull string to the bundle of wires is very important.

In addition, you want to make sure the wire bundle will pull easily through the attic. To that end, what you *don't* want is to line up all the cables to a big, blunt end like this:



Bundling the wires together in such a manner is asking for them to trip up on everything in sight. Instead, what you want to do is *stagger* them, so that the bundle has a nice, smooth taper. This will help it easily glide over any possible obstructions.

We can further facilitate a tapered bundle by doing a little prep to each wire, since each has a blunt end. So, take your side cutters and cut the end of each wire at a hard angle, like this:

With speaker cable, separate the two conductors, cut one shorter, then angle-cut both leads, like so:

Please note, the picture is for illustration purposes only. This is *not* the speaker cable you should be pulling through attics! What you should be using is CL-2 or –3 rated speaker wire (which I didn't have on hand for these pictures – it's all in my attic ☺). CL-rated wire will typically have a white outer jacket, with red and black insulated conductors inside.

With all the wire ends angle-cut, we can secure them to the pull string. Tie the *other* end of the pull string (not the end where the chain is!) around one of the larger cables to be pulled – we'll use an RG-6 coaxial for our illustration – and secure it with (red) tape, like so:

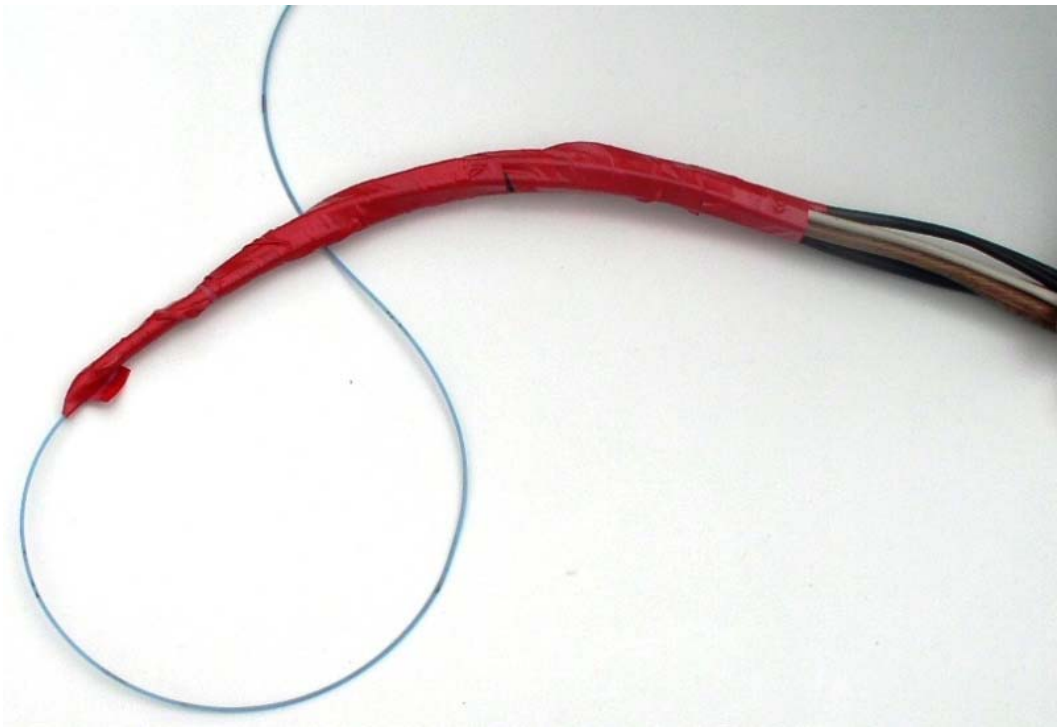
What does this do for us? Well, if our bundle *does* hang on something, when we pull harder on the string the knot will tighten around the cable, gripping it harder. (For added security you might give the tail of the pull string a few more wraps of tape, but I generally have not found that to be necessary.) If we merely tape the pull string paralleled to the RG-6 without tying it off, there's a good chance the tape alone will not be able to hold it if the going gets rough. Again – voice of experience here! You can try it yourself an see how easily the pull string will break lose if it's not tied to the coaxial.

Also note, I recommend "flagging" the end of all tape wraps by folding the end over onto itself. This will make it easy to unwrap the tape once you're finished.

With our pull string secure to the wire, we can add each cable to our bundle in a staggered formation, like so (note flagged tape ends!):

If you're wondering why we're only securing the pull string to a single cable, not the entire bundle, it's because the knot won't grip a lumpy, uneven bundle of wires as well as it will a single one. Plus if one cable gets separated from the bundle, the knot is compromised. So, basically, the pull string pulls the single cable; the other wires in the bundle are merely "along for the ride," as it were.

After all cables are staggered and secured to the RG-6, spiral-wrap electrical tape down towards the end of the bundle, and over the pull string:



So now we have a nice, tapered bundle that should easily glide over cross braces and other obstructions.

Once you're in the attic and dropping the wire bundle down into the wall, it will be difficult to know when you've let enough in. We can make a special provision now that will help us later.

First, decide how much wire you want to come out of the wall. Again, it doesn't hurt to be generous here, making sure you will have enough slack for in-rack routing, and maybe some extra in case you want to re-arrange things at some point in the future. Then add to that figure the distance that will be inside the wall. At that total figure, wrap a loop of tape around the wire bundle to serve as a marker. So if you need ten feet between the wall and the equipment, and you have eight-foot ceilings, you'll want to mark the bundle at 18 ft. (You will only need this marker at the equipment location, which is where you'll be dropping in first. At the speaker locations, you will drop in whatever slack is left.)

Here's another helpful tip: If you're dealing with several wires, and your bundle is more than about 15-20 ft. long, you will have a problem. All those wires are going to end up getting tangled up into a big rat's nest. They will end up having all kinds of loops (from being wrapped up on a spool) and knots, especially towards the tail end, that can easily hang up once you're in the attic.

The way to avoid this problem is to wrap a loop of tape around the bundle at ~10 foot intervals, from one end to the other. This will keep your bundle organized and under control. If you have a complicated wire pull with wiring going different locations in the attic (as it typically the case) you can "split off" groups of wires into separately taped "sub-bundles."

If you do this *(and you should),* you will need some means to differentiate the "this is all we need" marker – a different color of tape, or perhaps two wraps instead of a single one.

I know all this measuring to length, staggered taping, and bundling takes some time to set up, but trust me, it'll make things a breeze once you get in the attic. Who wants to spend any more time up there than they have to?

Let's pull some wire!

Okay, on to the attic with the work light, pre-cut and prepped wire bundle, drill outfitted with the auger bit, and of course your extension cord and three-way tap. I like to take a couple of scrap 1" x12" boards to lie across the joists, so I have something to kneel on. Trust me, attic work is a lot easier not having to straddle those skinny joists on your knees.

We used a flashlight before for our "find the coat hanger" expedition, and you can certainly use one for this part, too. But when the real work begins but I prefer a work light that I can clamp to a rafter overhead. This gives a well-lit work area, and you don't have to worry about juggling a flashlight while drilling your holes, which really takes two hands. You have to drag an extension cord and electric drill up there anyway - might as well bring along a three-way tap and good light, too.

Start first with the equipment location. When you find your coat hanger, pull back the insulation and look for the horizontal 2" x 4" top plate next to it. As we mentioned earlier, drilling through the top plate will put you inside the wall. Drill your 3/4" hole into the center of the top plate, directly perpendicular to your coat hanger wire (see "x marks the spot" picture above). In some cases you'll be drilling through a double-stacked 2" x 4" top plate, so you'll be glad you're using an auger bit instead of a paddle bit.

Afterwards you should see daylight through the hole; that's from the hole in the wall you cut downstairs. If so, all is well! (If you had to move your hole over from where you had originally planned to drill to avoid an obstruction, or if you had to drill through the top plate at an angle, you might not be able to see light.)

Okay, you're ready to drop in the wire. It helps to have someone down in the room to pull it out of the wall, especially at the equipment location where the bundle is large.

Drop the pull string down the hole and get your helper to pull it out of the wall. Then you can feed the wires in until you come to your "this is all we need" marker. With the marker just at the entrance of the hole in the top plate, you now have enough wire in place. (NOTE: Depending on how much wiring your system requires, it might not all fit down the 3/4" hole. If that's the case drill another hole or two in the top plate and split your bundle between them.)

If you don't have a helper, you can go back downstairs and pull the wire in yourself, once you have the tapered end fed into the hole. But if you're doing it this way, you should relocate your "this is all we need" marker so that it is "enough" when it appears at the hole in the wall. A simple re-adjustment.

Once the equipment rack bundle is pulled in, on to the rear speaker locations, drill and drop.

Finishing details

Back downstairs, route the wiring through the old work boxes and install them into the wall with the Phillips screw driver, as discussed previously. You can dress out the speaker locations simply by using a blank cover with a hole drilled in the center to run the wires through. Some people like to use covers with banana connectors, but I prefer to take the wire directly out of the wall, for an uninterrupted path between the speaker and receiver.

The reason I'm not big on banana plug wall plates is that each one adds four additional termination points *per location*, all potential places for a problem.

For instance, most banana plugs and binding posts use set screws or a similar clamping method. The problem is that over time, the stranded speaker wire crushes down and the connection is no longer tight. Anyone who's ever cranked down their banana plugs as tight as they could, only to find a year or two later they can get another full turn out of the screw knows what I'm talking about! Using an uninterrupted wire from receiver to speaker is simpler, cheaper and more reliable. Win, win, win. You can always push excess slack back into the wall. (Of course, using wall-mounted binding posts does allow you to transition from in-wall CL-2 or -3 to "pretty" speaker wire, if the wire ends up being visible – I'll admit that CL stuff is pretty ugly.)

At the equipment location, I typically don't opt for a cover at all, since it's hidden behind the rack anyway. However, a bulk-wire wall plate is cheap enough, so there's no good reason not to use one.

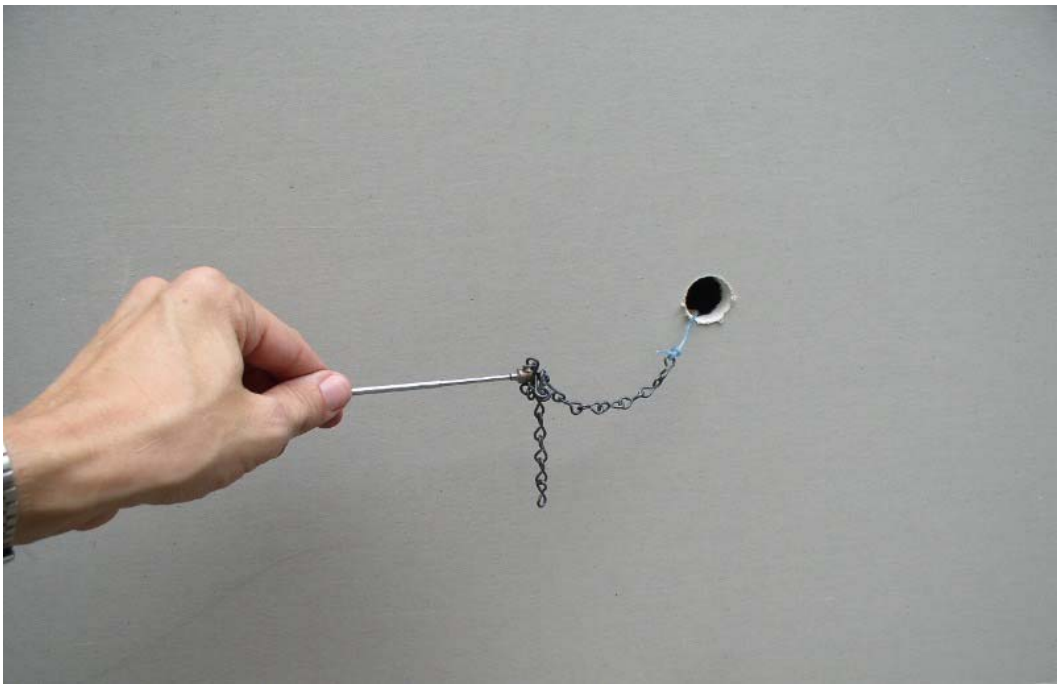
The tiny holes in the ceiling where the coat hangers poked through are nothing to worry about - too small to see without really looking for it. But if you're really detailed, you might want to dab a little spackling in it. Clean off the excess with a wet rag.

Bringing wire straight out of the wall to the speakers

If you want to drop the wiring at the speaker locations straight out of the wall through a small hole, using no old work boxes, that can be a challenge. It's pretty tough to work through a tiny hole in the wall. But if you know a few tricks of the trade, it's actually pretty easy.

First, your hole in the top plate needs to be dead-on directly above the hole in the wall where you want the speaker wire (if you drilled into it directly perpendicular to the coat hanger wire, then it already is). All you need to do then is measure the distance between the hole in the wall and the ceiling, and in the attic, drop the pull string so that the end of the weighting chain is an inch or two below the hole in the wall.

Back in the room, stick your telescoping antenna magnet into the hole in the wall. It will snag the chain, and you can pull it out of the hole.



If you thought you wouldn't need this little gizmo, or the chain tied to the pull string didn't need to be ferrous – now you know better!

Special considerations for crawl spaces

If you're dealing with crawl spaces or under-house wiring, the procedure for getting wiring inside the wall will be a bit different, since the wiring will be coming in from the bottom plate, not the top plate.

First, as discussed above, you will locate the studs with the stud finder, to make sure your desired location is between them. Then cut a hole in the wall for an old-work box. Once the hole is cut, we will need to drill through the bottom plate. Since we obviously can't stick a drill motor into a hole the size of an electrical outlet box, it will be necessary to use a long 18" drill bit; something in the 1/4-3/8" range will work fine.

Once you drill through the bottom plate, drop something through the hole to help you locate it once you enter the crawl space, like the chain end of your pull string. Once you locate the hole, you may want to enlarge it with the 3/4" auger bit, especially if you're routing a lot of wiring through it. Be sure and use safety glasses!

Depending on your flooring, for crawl spaces or under-house wiring there might not be an option for "check for obstructions below before cutting holes in the wall." If you have a carpeted floor, you can pull the rug back and drill a small test-hole in the floor and stick the end of a coat hanger through it, as outlined above for attics. Obviously if you have some other kind of flooring, like hardwood or tile, this is out of the question. However, you may be able to figure out if your location is obstruction-free by careful measurement.

Wiring for wall-mounted speaker locations without cutting an old-work-box access hole will be fairly difficult, if not impossible, to accomplish with under-house or crawl spaces. The only thing that comes to mind would be to use a wiring tone generator and probe. The tone generator would connect to a piece of speaker wire dropped inside the wall from the desired mounting location. It would need to be long enough to get all the way to the bottom of the wall, and it would be located in the crawl space with the probe. Once a hole was drilled into the bottom plate, you would drop the pull string and chain from the speaker location and fish it through the hole in the bottom plate with the telescoping magnet.

However, seeing as tone generator/probe kits cost upwards of $100, I expect that most "weekend warriors" will simply opt to cut an old-work-box access hole down at electrical outlet height and cover it with a blank. With the access hole in place you would drill through the base plate as described above.

Wrap-up

Just for grins, here's an attic picture of the equipment-location drop at our place. It's a cathedral ceiling family room with a staircase behind this wall, with the cables all dropping down to a converted wet bar beneath the stairs. What you're looking at here is an unusual situation, a 2" x 8" beam sitting *right on the top plate*. So I had to drill into it at an angle to hit the top plate underneath. Just goes to show, you never know what you're going to encounter in an installation. Notice that it took three holes to get all my cabling in. Lots of coax – two satellite feeds, high-speed internet, TV and FM antennas, not to mention telephone and a line feed for audio from my computer. Note the correct CL-2 (white) speaker wires for the back surround channels, as well as the "enough" tape markers. ☺

Now that you know how to retro in-wall wiring, you'll probably find yourself wanting to put in all kinds of other wiring around the

house – extra phone jacks and cable TV drops in the kid's bedrooms, second-zone audio and video feeds to other rooms, etc. Maybe even dedicated electrical circuits. Hmm, good idea - maybe I'll do an article on that someday.

Please address any questions or discussion to this thread. Experienced installers are encouraged to add their tips!

Rules

08-21-07, 06:09 PM #3

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How to: In-Wall Wiring for Your Home Theater

Part 2: Dealing with a Cross Brace in the Wall

Cross braces are the bane of the installer's existence. Okay, maybe one of many banes! Unfortunately, there's no way around it, a cross brace will require putting holes in the wall if you intend to get a wire below it.

There is at least one possible work-around - if you happen to have a closet or other non-essential room behind the wall you want to get the wire into. If you don't care if it's exposed, you could simply drop the wire out of the attic through the closet ceiling, route as needed and go straight through the wall at your desired location. Maybe use a wire channel to keep things as tidy as possible.

If that's not an option, there's probably no way to avoid drilling or cutting a hole in the wall that will have to be repaired. If your sheetrock patching skills are like mine – marginal – you may end up needing a picture or something on the wall to hide the patched place.

There are at least a few ways to accomplish this objective. Here is a tool and supply list; exactly what you need will depend on which method (described below) you decide to go with.

Tools

- **Electronic stud finder.**
- **Electric drill.** As before, I recommend a heavy-duty model with a side-handle.
- **3/4" auger bit.**
- **Cordless drill (optional).**
- **Assorted drill bits.**
- **Drywall (aka sheetrock) saw.**
- **A narrow putty knife.**
- **Small "torpedo" level.**
- **A pencil.**
- **Telescoping magnet "antenna."**
- **#2 Phillips screw driver.**
- **Electrical tape.**
- **Countersink bit.**

Supplies

- **Drywall joint compound.**
- **A few toothpicks.** The round variety will work best. These will simply be used for shims, so if you want to use something else, feel free!
- **A small, thin piece of wood.**
- **A few sheet rock screws.**
- **A wet rag.**
- **Matching wall paint and assorted painting supplies.**
- **Two (2) old-work electrical boxes.**
- **A blank cover** for one electrical box; your choice of covers for the other one.

Our first two methods go hand in hand; the only difference between them is the way you cover up the sizable hole you will need to cut in the wall. "Sizeable hole" – I know that sounds frightening, but trust me, it's not a big deal! Follow along and see.

Method one, you can cut a hole to access the cross brace with the intent of concealing it afterwards with an old-work box and blank cover. If your wall is papered, this is probably your only viable option.

Method two, you can cut a hole with the intent of doing a little sheetrock repair afterwards. It's not hard if you have painted walls, but it can be tricky to make it look like a hole was never there. As noted, be prepared to hang a picture or something afterwards. Or just keep the lights dim – hey, this is a home theater after all!

If you want to try the hole-patching method but are a bit nervous about your skills with drywall mud and putty knives, after reading the info below you might to practice a "trial run" in that non-essential closet, or some other out-of-the-way location. ☺

Here's a step-by-step, with pictures that I took when I was doing our home theater installation a while back. It will work as a reference for both methods. (My apologies for the poor quality of the pictures – I only had a cheapie digital camera at the time.) My challenge was a bit different – drilling through the bottom plate of a second-story wall, to drop a wire from the attic down to the first floor. But the concept is the same – just pretend the base plate is your cross brace. ☺

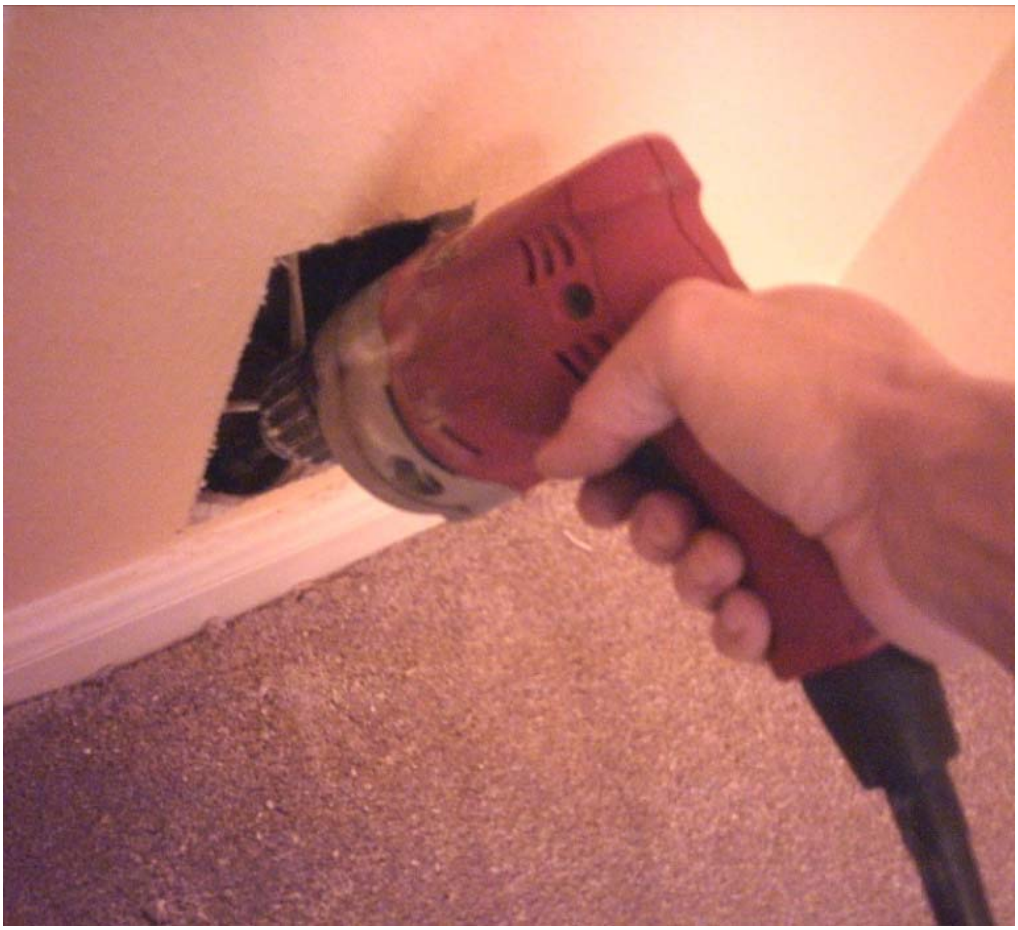
Let's get started

First, precisely locate the cross brace with the stud finder, then cut an access hole in the wall right above it with the drywall saw. If you'll be using an old work box, move up an inch or so above the brace, to allow the tab to fold down (see how-to directions for installing an old work box in Part 1, "Finish in-room preparations" section).

Even if you intend to go the patch-the-hole route, I strongly recommend a vertically-oriented rectangular hole, similar to what you'd be cutting if you *were* using an old-work box. Obviously you don't have to adhere to those dimensions; the hole doesn't need to be very wide to accommodate an auger bit, for instance. However, some vertical height is needed to allow the drill bit in-wall access and to minimize the drilling angle.

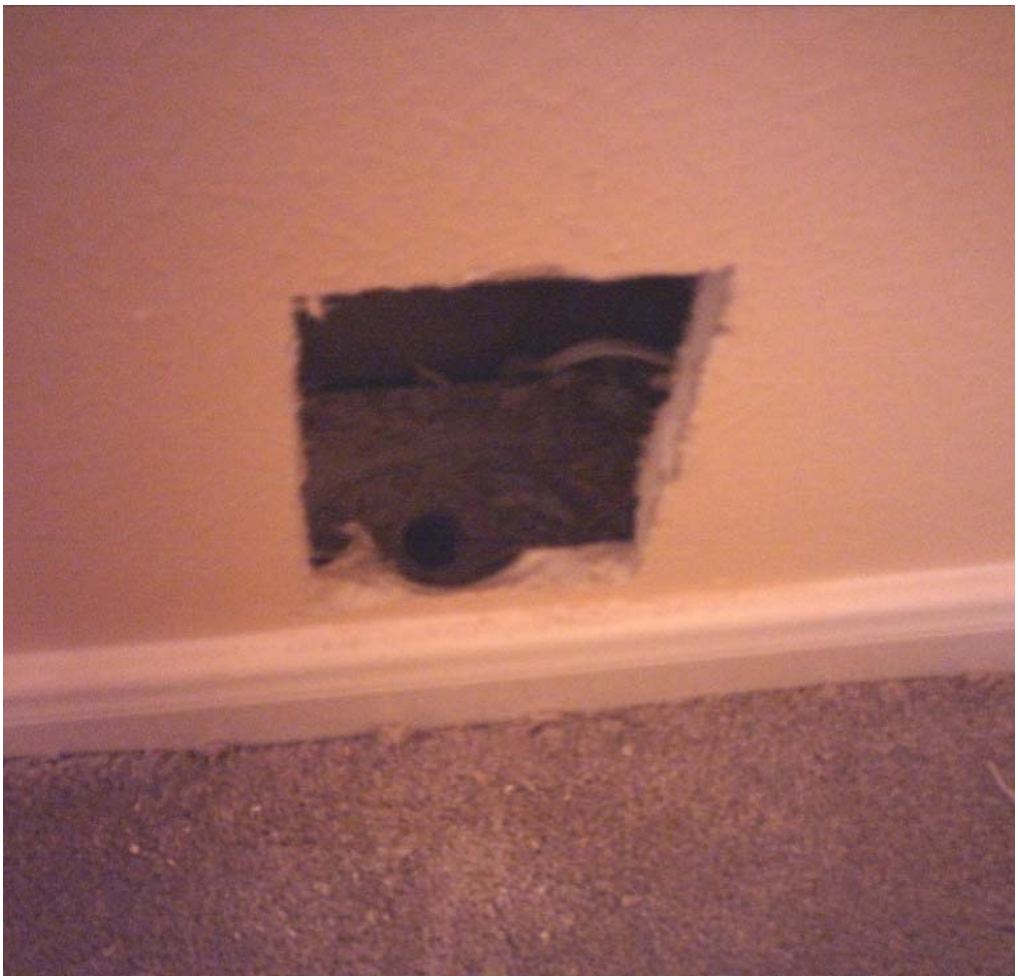
You will want to take care that the rectangular piece of sheetrock you cut comes out in one piece, as intact as possible. Set it aside, because we will be using it again later. Here's a picture with the hole cut, along with some of the supplies we'll be using later for the patch-up.

Next, drill a hole through the cross brace, using the auger bit.



If you took my advice from Part 1 and chose an auger bit over a paddle bit, at this point you will be glad you did. This is because you will have to drill through the cross brace at a slight angle. As far as I know (being a better wiring guy than carpenter), paddle bits have to be pretty much perpendicular, so I doubt one will work very well here.

Here's a picture after drilling. You can see the hole in the base plate-cum-cross brace, and our speaker wire (white) already in place, waiting to be dropped.



(Note the damage to the sheetrock, bottom-center of the hole, and top-center. This is merely an anomaly of my particular installation – nothing for you to be concerned about. Since I had a baseboard in place, I couldn't get the cut-out in the wall as close to the base plate (cross brace) as it needed to go. So the drill ended up sinking into the wall more than it otherwise would have, and the chuck chewed up the sheetrock. A longer auger was really needed, but those things aren't cheap!)

As discussed in Part 1, if you're dropping a lot of wiring you might require an additional hole or two in the brace.

Next, go ahead and drop your cable down through the cross brace (as you can see from the pictures, it's perfectly fine to drop in the wiring ahead of time). If you haven't already, cut the hole for the lower old-work box down at outlet height and pull enough wire out of the wall to make your connection.

If you're going with the old-work-box method to cover up the access hole, pop it in, install the blank cover and pour a cold Luzianne, 'cause you're done!

Repairing the sheetrock hole

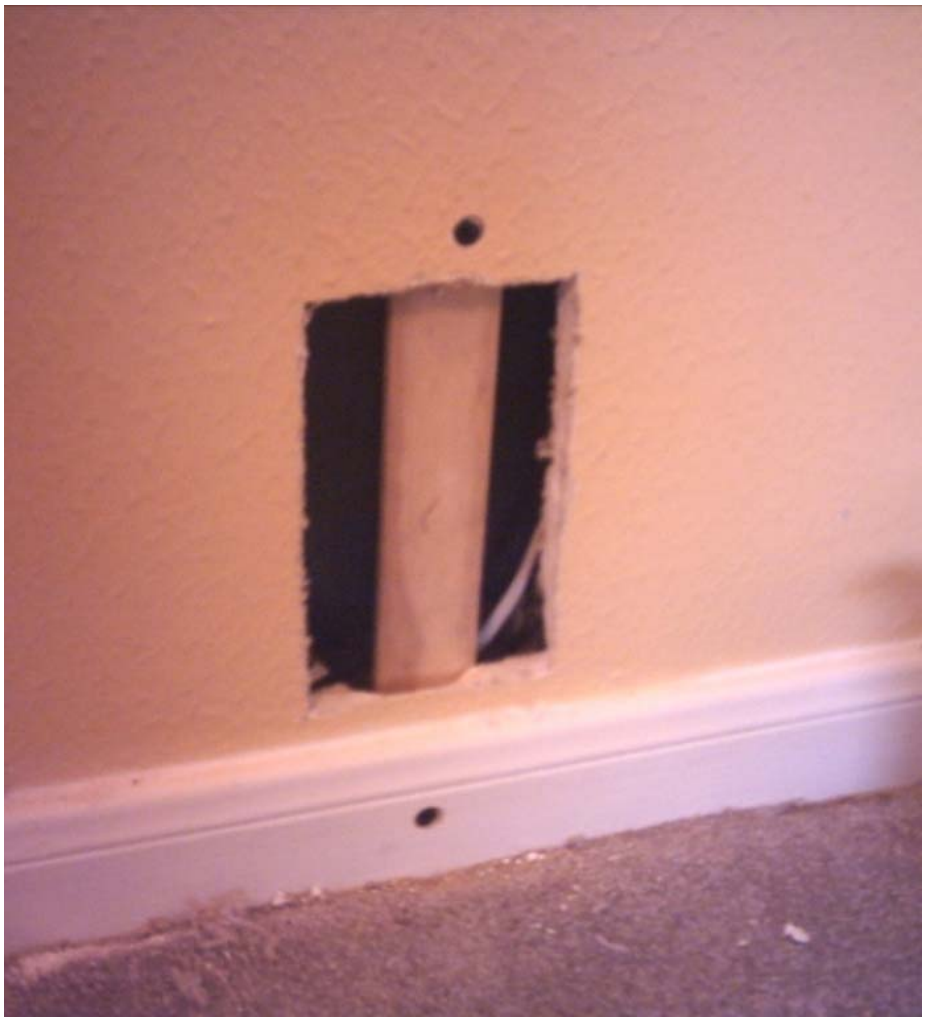
The flat piece of wood you see a few pictures back is going to be used as a rear support to hold the piece of cutout sheetrock back in place. As you can see in the picture, cut the wood so that it's a couple of inches wider than the hole is.

Center the piece of wood over the hole and drill two small pilot holes (suitable for the sheetrock screws you'll be using) through the wood and into the wall. The pilot holes in the wall should be a half-inch or so above and below our cutout.

Now enlarge the pilot holes in the wall (but not the wood!). Use a bit that's the same diameter as the sheetrock screws. In other words, the screws should snugly fit through the holes.

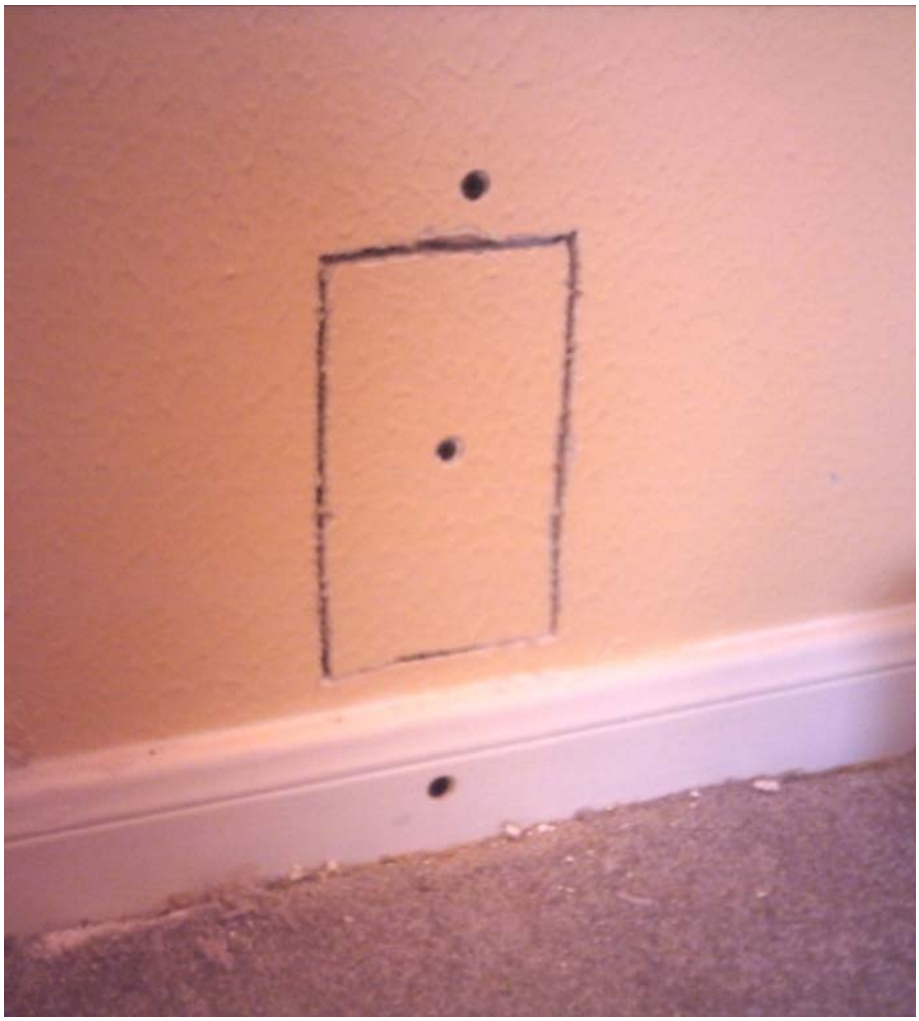
Next, use the countersink bit in the drill motor to sink the pilot holes into the wall. (In lieu of a countersink, an oversized drill bit will work – *but do it by hand,* not with the drill motor!) Insert the screws into the holes to check the countersink depth. The heads of the screws should be slightly recessed below the surface.

Now you're ready to put it all together. Hold the back support in place and screw the sheetrock screws through the pre-drilled and counter-sunk holes in the wall, and into the back support's pilot holes, snugging it into position to the backside of the sheetrock. This picture shows what things should look like at this point:



Next, put the piece of cutout sheetrock into position. Use the toothpicks as shims to center it in the hole.

Now, drill a pilot hole through the center of the cutout sheetrock and into the support behind it. Remove the sheetrock and enlarge and countersink the hole, as before. Afterwards, put the sheetrock back in place, using the shims, and screw it to the brace. This picture shows what things should look like at this point. Note that all three screws are fully recessed.



Now to patch everything up. Dab some drywall compound on your finger and force it into the crack around the cutout. Use the putty knife for compounding over the screw holes, since they are a bit larger area. Scrape off as much excess compound as possible with the putty knife, and then use a wet rag to wipe away whatever is left. It's important to get as much excess compound off the wall as possible, to avoid obscuring the texturing. If you don't get the joint compound flush with the crack, don't sweat it. Sometimes it wants to "sink" in. If that happens, just let it set up and re-apply; you will be able to get it flush with the second application.

Here's what it will look like after compounding, but before detailing with a wet rag (you need to wet-rag it pretty quick, before it dries). Let the compound set, then paint. Voila, you're done!

Hopefully you can see the advantage of this method over the one we're about to discuss below. While there is a sizable hole cut in the wall, the actual damage to the sheetrock is minimal – just the thickness of the saw blade. That makes repair pretty easy. With any luck, it will hardly be noticeable.

Here's a close-up picture after painting, taken with a better camera. As you can see, up close it's not hard to tell where the work was done.

At the time I didn't know about the wet rag trick for cleaning up excess compound; I'm confident it would look *much* better if I had. But even at that, I had to look at a few different angles before the patch was noticeable. Take a step back and you can't see a thing:

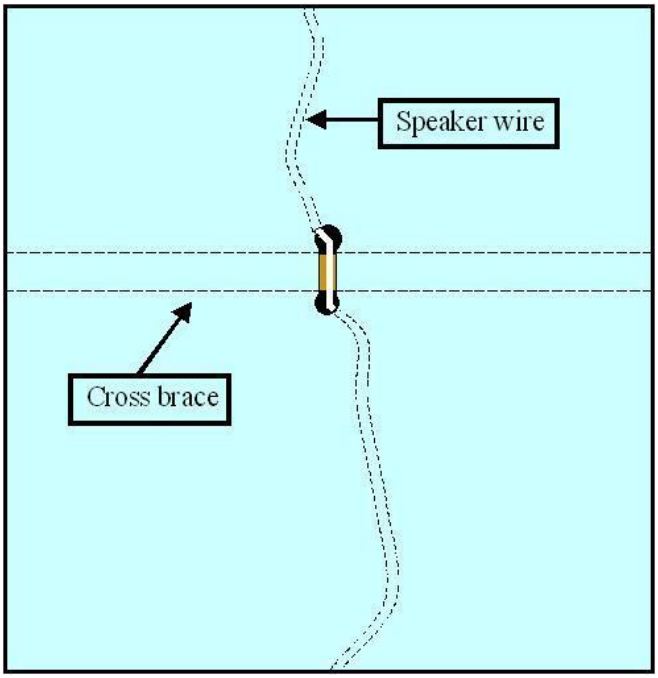
Fortunately, in my situation the hole was at the bottom of the wall, and the way the light shines into the room – straight on from a window on the opposite wall - helps hide it. If the room was lit by a side window, the shadowing effect probably would make the patch more noticeable. Your room lighting situation might be something for you to keep in mind.

An alternative method

Our last method takes a different approach, routing the wire *around* the brace rather than through it. It's accomplished using a variation of the "bring the speaker wire straight out of a small hole" trick described at the end of Part 1, utilizing the telescoping magnet. You might want to refer to that section for any details that might be lacking here.

After precisely locating your cross brace with the stud finder, drill a couple of holes straight into the wall, directly above and below it. Obviously, the holes have to be big enough for the magnet to pull the chain out (although the lower hole can be a bit smaller, if you prefer). After that, use the drywall saw to notch out the sheetrock between the two holes, making a "trench" that's about as wide as your speaker wire is thick.

As described in Part 1, measure the distance between the ceiling and the top hole, drop your pull string/chain from the attic, and snag it with the magnet. Once you pull in enough wire you can drop it all through the second hole and into the lower section of the wall. Here's a crude drawing showing what the finished "product" will look like:



The idea is for the wire to recess below the surface of the sheetrock, right up against the cross brace. Once covered over with drywall compound, it will essentially be embedded in the wall. You'll probably have to do some bending of the wire to shape it, to ensure that it remains recessed.

It should be obvious that this method is viable for only a limited number of wires – i.e., I wouldn't try this for the equipment location.

While this method requires smaller holes than the one discussed above, it actually is more invasive to the wall, as far as after-the-fact repairs are concerned. Instead of a thin saw-blade and small screw holes, you have a much larger surface area to compound and blend in. It will be pretty tough to make this look reasonably unnoticeable unless you have really good sheetrock skills that include texture matching. The holes above and below the brace will most likely require two or even three passes of compound before it'll be flush with the wall again.

Unless you have a compelling reason to go this route, I recommend the cutout method instead.

Please address any questions or discussion to this thread. Experienced installers are encouraged to add their own tips!

Rules

08-21-07, 06:42 PM #4

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How to: In-Wall Wiring for Your Home Theater

Part 3: Dealing with Inaccessible Places in the Attic

Getting the wiring from point A to B – that's the challenge

In many homes there may be an inaccessible section of the attic that you need to run a wire through. For instance, let's say your family room has a cathedral ceiling, and your equipment location is on one side of the room and the rear speakers on the other. It may be that the only place in the attic to route the wires between those locations is a tiny chase that's too small for man nor beast. And, it's 20 ft. long!

That's a challenge, for sure. Professional installers use a special tool for situations like this - long, extendable rods to span the inaccessible distance. Typically extension poles come in one of two varieties: Short 2' sections of fiberglass or aluminum rods that screw together end to end, or telescoping poles.

I recommend the kind with the screw-together sections, rather than the telescoping pole. If you've read our installments above you already know why: the screw-together type will be more streamlined than the telescoping pole. Those bulbous clutches between the sections are going to hang up on every joist and perpendicular beam you come across!

The installer will tape the wire to the front end of the push pole and add additional sections one at a time, pushing through until the inaccessible area has been fully spanned. On the other side, the wire is retrieved and pulled on to its destination. If multiple wires are being pulled, a pull string is pushed through instead, and the bundle of wires tied off to it, as we described in Part 1. It's not a good idea to tape a lot of wires to the push pole directly, as – you guessed it - they will snag on joists and other obstacles.

Here's a picture of a push pole of the not-recommended telescoping variety being used above a hung ceiling, such as you typically find in an office building. Working in houses, the push pole will be laying directly on joists, unlike in this picture.

Push poles are dandy gizmos for situations like this, but you'll find they aren't cheap – typically approaching $100 for anything that'll get you a decent distance (20-25 ft.). Most home theater DIYers aren't going to want to lay out that kind of money for something they'll probably use only a few times. However, with a modicum of effort we can make a push pole using 1/2" PVC pipe, typically available at your local hardware store for a couple dollars per section, and 1/2" copper pipe couplers. Yes, copper couplers; as we shall see, they are preferable to PVC couplers. Hey, this a DIY project, so why not DIY your push poles too? 😊

Here's a list of the tools and supplies we'll be needing.

Tools

- **Cordless drill.** If you can beg or borrow a second one, it will really be helpful.
- **Assorted drill bits.**
- **Work light with built-in clamp.** See picture in Part 1.
- **Extension cord.**
- **Pull string w/ weighting chain.** See Part 1 for details – length as needed for your application.
- **Electrical tape.**
- **A bag** of some kind, for all the small parts you'll be toting up to the attic.
- **A few 1" x 12" boards** about 3 ft. long. Optional, but highly recommended.
- **#2 Phillips screw driver tip.**.
- **Magnetic screw driver tip holder** for the cordless drill.

Supplies

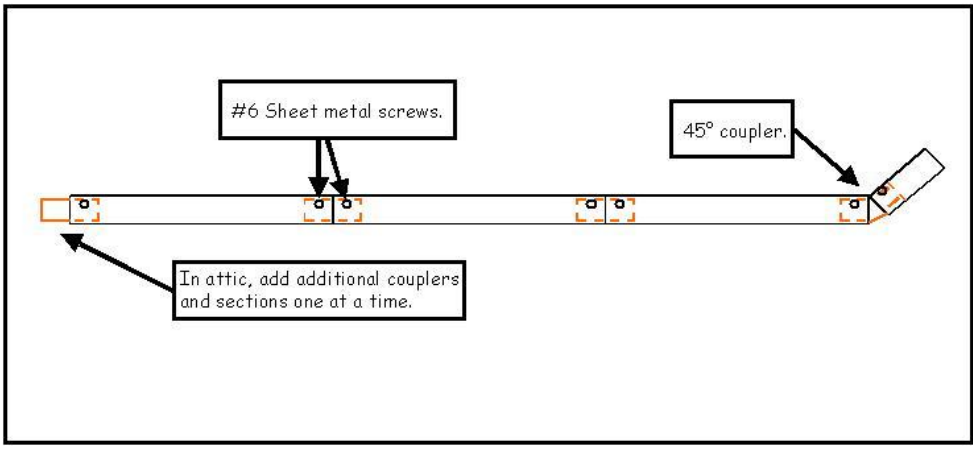
- **1/2" PVC-DWW pipe.** Quantity as needed.
- **1/2" copper-pipe couplers.** Quantity as needed.
- **One (1) 1/2" copper pipe 45° coupler.**
- **#6 x 3/8" Phillips pan head sheet metal screws.** Quantity as needed.

Getting started with DIY push poles: A few particulars

The first thing to do, naturally, is determine the distance you need to span, and buy enough PVC pipe and couplers for the job. Get a few feet more than you need, to allow a foot or so at each end to work with. Be sure and pick up a 45° coupler as well – it's an important piece.

The beauty of using 1/2"copper pipe couplers is that they fit snuggly *inside* the 1/2" PVC-DWW pipe we're using. That's right – with internal couplers, the PVC pieces will mate perfectly end to end, so there will be nothing that can hang us up in the attic. Cool, huh? (NOTE: Copper pipe couplers will not fit inside Schedule 40 PVC, so stick with the recommended PVC-DWW. It's cheaper, too.)

As they say, a picture is worth a thousand words; in lieu of that I put together a crude drawing of how our homemade extension poles are going to be assembled:



When you buy the PVC pipe you'll find it comes in 5' or 10' sections, the latter being more economical. If you can't accommodate those lengths, you'll have to cut the pipe down to shorter sections. You'll want to scope out what you can deal with in your attic before you go shopping; you'll obviously need additional couplers and screws for every section.

The fun begins

You can start by assembling your first section with the 45° coupler and short piece in front before going to the attic, to determine ahead of time the best drill bit size for the pilot hole. Once you get in the attic with your kneeling boards, work light and assorted tools and supplies, you will assemble the sections, securing them to the couplers with the #6 sheet metal screws. Each added section will be pushed through the inaccessible area towards the other side, as described previously. You'll probably want to have two battery-powered drills – one for the pilot holes, one for the screws. This will certainly speed things up, which is a good thing as attic work typically isn't terribly comfortable. I highly recommend the magnetic tip holder for the #2 Phillips screwdriver tip – it'll make things much easier.

The couplers fit into the pipe pretty snuggly, so you may opt to forgo the screws. The assembly certainly isn't going to fall apart as long as you're pushing it. But if you hang up on something and have to pull back to re-push, there's a chance it'll separate, especially if you have a lot of sections. It won't be the end of the world; you will be able to pull both sections back out (the stranded section can be retrieved using the attached pull string or speaker wire). But it will delay the project.

The 45° coupler and short piece in front of the assembly serve an important purpose. The longer the push pole gets, the more it will tend to sag (as the picture above shows). As you add each new section and push the pole forward, make sure the 45 remains turned *upward*. This way it will glide up and over any beams and joists. Assemble with the #6 screws towards the top as well, to prevent them from being a cause of hang-ups.

If you're only trying to get a single speaker wire from one side to the other, you can tape the wire near the front end of the assembly, behind the 45° coupler. Tape it so that the wire is on top – I think by now you know why! (Don't forget to flag the tape!)

However, if you have multiple wires to pull through the inaccessible area, it's best to use a pull string instead. Naturally it will need to be long enough to span the entire length, with a few feet of slack at each end. Once the pull string is in place, you can secure all the wires to it and pull them in. It will be especially important to use the staggered-attachment method as described in Part 1, to insure the bundle is as streamlined as possible, since you'll probably be pulling across numerous joists.

A little installer's tip: When you pull in the wires, tie another pull string into the bundle with them. This way, should you ever need to pull additional cables through this space, you'll already have a pull string in place.

Any volunteers for this project?

I'll be perfectly honest here: I've never tried this before. The homemade push poles, that is (the real ones I have, and they're dandy). This is something I dreamed up while preparing this article, so, I'm not entirely sure how well it will work - although I can't see any reason why it wouldn't. The only possible caveat that comes to mind is that with really long distances the PVC might start to buckle, since it's not nearly as rigid as real push poles are. It should be good for a distance of 20-25 ft, though. Maybe someone will try it and give us some feedback. [EDIT: We have a taker! Smitty tried the DIY push poles and said it worked fine. See here.]

As a side note, so-called CPVC pipe, rated for hot/cold water applications, can also be used for this project, but it costs a bit more and gives us no advantage. It's a functional equivalent of copper pipe, to the extent that copper couplers can be used instead of CPVC items. Unlike with our proposed assembly, CPVC couplers fit *over* the pipe, making a potential hang-up problem. The advantage of the copper couplers is that they are low-profile – i.e., less hanging-up potential compared to the CPVC couplers.

Other tips for inaccessible areas

In some situations there will be no other option except to drop the wire out of the attic and run outside the house - under an eave, preferably - and re-enter the attic on the other side of your inaccessible location. If there is no eave, it's best to run the wire in some kind of conduit. PVC is fine for low voltage applications like this.

In situations where the roof has a shallow incline sloping down to the eave, it can be a tight squeeze accessing the place where you want to drop the wire out of the attic. A good trick there is to use a long, thick wire and stick it up from the eave into the attic, far enough so that you can grab it. Angle-cut and tape your cable on and pull it back out. An ideal wire for this is the heavy-duty stuff they use for suspended ceilings, as you typically see in office buildings. Alternately, you might be able to pick up a thin piece of aluminum bar stock at the hardware store. If all else fails use your imagination to come up with something. After all, being able to come up with a new game plan on the fly is part and parcel to retro-installations. ☺

Another common installer's technique for difficult places such as cathedral ceilings with no attic above them, and outside walls that are full of insulation and possibly have one of those low-sloping roofs, is the old "use what's already there" trick. Down in the room, where there is an existing cable TV or phone jack, tape a pull string to the existing wire. In the attic, pull it up all the way up the wall to you. *Voila,* you now have a pull string in place! Attach your wiring to the pull string as we've described previously, including the old cable, if you need it back in place, and pull everything back down the wall.

There are a few of "gotchas" to watch out for. For one, how much cabling you can pull back in will depend on the size of the hole that was originally drilled in the top plate. We were pretty lucky at a friend's house where we tried this trick. The hole for the builder-installed cable TV coaxial was big enough to get in a few more coaxials for the satellite receiver and TV antenna.

Second, if you're pulling in multiple new wires, there's a good chance they won't all fit in the single hole in the electrical box your string is going through. I suggest removing the existing box altogether and installing an old work box afterwards. You can pry off the existing box nailed to the stud after first pushing it from flush to behind the sheetrock, but this is a real pain and almost always ends up damaging the sheetrock. My recommendation is to cut the mounting nails with a sawz-all outfitted with a metal cutting blade. The blade will slide in right between the box and the stud and cut through the nails like butter. In lieu of a sawz-all, a saber saw will work, but you'll have to protect the sheetrock with a piece of cardboard or something taped to the wall. After cutting, use a hammer to drive the nail tips flush into the stud.

Third, you *really* you want to pay special attention when preparing your bundle and pull string for this one, because you'll be going through that top plate at a hard angle. You'll most assuredly have to yank on the pull string pretty hard when the wiring gets to the top plate. So I suggest tying the off the pull string to the main cable in two places, not just one as we described in Part 1. And, making sure all those added cables are attached as streamlined as possible. If your pull string separates from the bundle, you are *hosed*. So take care to do it right! It'll be *most* helpful in this case to have someone in the attic feeding in the bundle as you pull downstairs.

Please address any questions or discussion to this thread. Experienced installers are encouraged to add their own tips!

Rules

01-11-08, 04:06 PM #5

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My Photos

How to: In-Wall Wiring for Your Home Theater

Part 4: Running Wire From Baseboards up to Wall-Mounted Speakers

Another common retro-wiring challenge is getting speaker wires in the wall to wall-mounted speakers, from inside the room. This is often the case if you have carpeted floors. Carpet is great all around for home theaters. It helps with acoustics, and it's easy to hide wiring around the baseboard by stuffing it down "below grade," as it were. So, with a carpeted room it's often easy to get wire to the rear speakers without using the attic.

Naturally, carpet makes it easy to hide the wires for the front speakers as well, even if you do run your rear-speaker wiring through the attic. In our previous house, I not only hid the wires to the front speakers, I also cut a small hole in the carpet directly behind the speakers, which were a foot or so out from the wall, and routed the wire up through the hole from underneath. I then taped the wire to the back of the speaker, all the way up to the terminals, using black electrical tape. Approaching the speaker from the side, it looked like it was freestanding with no wire at all! Naturally, this visual trick will work best with zip-cord-type or flat speaker wire.

There are a couple variations on this in-wall technique, which is itself a variation of the "Bringing the wire straight out of the wall to the speakers" description in the second post of Part 1 – you might want to review that section. The simplest method is to have the speaker wire enter the wall right above the baseboard. This does leave a small length of wire visible between the carpet and top of the baseboard. If you're using CL-2 or –3 wire, which you probably should be (since it's going inside the wall), you can get it with a white jacket so the wire will hardly be noticed (assuming your baseboards are white ☺). If you want a completely clean installation with no wire showing, an alternative method is to drill into the baseboard "below grade" i.e., below the top of the carpet, and enter the wall at that point. However, this is more difficult as it will require some sheetrock repair, as outlined in Part 2, Dealing with a Cross Brace in the Wall.

Here are the tools and supplies we'll be needing. Most of these are pictured in Part 1. The (*) indicates equipment and supplies needed if you want to get the wire into the wall at the bottom of the baseboard; if you're going in above the baseboard you won't need those items.

Tools

- **Electronic stud finder.**
- **Electric drill.*** As before, I recommend a heavy-duty model with a side-handle.
- **3/4" auger bit.**
- **Cordless drill.**
- **Assorted drill bits.**
- **Side cutters.**
- **Wire strippers** like the ones pictured here, but there are a variety of similar tools available.

- **A pull sting** that is a few feet longer than the distance between the baseboard and speaker location up on the wall.
- **A short 1-ft. length of light-duty chain,** for the pull string, as described and pictured in Part 1.
- **Drywall (aka sheetrock) saw.***
- **A narrow putty knife.***
- **A pencil.***
- **Telescoping magnet "antenna."**
- **A long drill bit, 12: or longer,** that's a larger diameter than your speaker wire.*
- **Needle nose pliers.***

Supplies

- **Electrical tape.**
- **Drywall joint compound.***
- **A few toothpicks.*** The round variety will work best. These will simply be used for shims, so if you want to use something else, feel free!
- **A small, thin piece of wood.***
- **A few sheet rock screws.***
- **A wet rag.***
- **Matching wall paint and assorted painting supplies.***

The easy method

The first step, obviously, is to run the wires from the equipment location around the baseboard to the speaker locations, leaving enough length to get up the wall to the speakers, with an extra foot or two of slack. Use your stud finder to make sure there are no internal braces in the wall between the proposed speaker location and the floor. (As mentioned in our previous installments, if you have ceilings higher than 8 feet, internal braces may be a problem.) Make a mark for the upper hole where the wire will come out of the wall, preferably directly behind the speaker.

Next, prep the pull string and chain, as described in the second post for Part 1. Hold the pull string/chain against the wall at the mark for the upper hole and adjust the length so that the chain dangles about a half-inch below where the lower hole will be just above the top of the baseboard. Have a helper mark the lower hole location for you. *It is **imperative** that two holes be in perfect alignment.* At the same time, wrap a piece of electrical tape on the pull string where the upper hole is. This will let you know how far to drop the pull string/chain into the wall to reach the lower hole.

Next, drill your two holes. Ideally, the holes should be just a bit large than the wire's diameter. (CL-2 and -3 wiring is round, which makes it a better choice for this than regular zip-cord speaker wire).

Now drop the pull string in the upper hole, chain first, all the way to the tape mark. Poke your telescoping magnet "antenna" into the lower hole; it will grab the chain and you can pull it out of the wall. If the chain won't come out of the wall, that means it's bunched up on the magnet. Get a helper to raise the string up a couple inches and then slowly lower it, until the magnet snags the very end of it. You'll be able to feel it when that happens. Or, you can just drill out the hole larger. Of course, since this going to be visible, I'm sure you'd prefer to keep the hole as small as possible. ☺

Voila! You now have a pull string in place to pull the speaker wire up the wall. Cool, huh? ☺

You can cut the chain off the pull string now; we don't need it any more (but keep it for the next location!). You may want to tape the upper end of the pull string to a screwdriver for the time being, to keep it from falling into the wall.

If you're using in-wall rated wire, strip back the outer jacket couple of inches, exposing the two inner conductors. If you're using regular zip-cord-type speaker wire, split out the two individual leads an inch or so. Whichever wire you're using, cut off one of the leads; we don't need both for what's next.

Use your wire strippers to strip the insulation off the remaining conductor an inch or so and bend it in a "U" shape and tie the pull string around it so that the "U" hooks in the loop of the knot. Using the electrical tape, wrap over the speaker wire, knot and pull string in a nice, smooth spiral. Remember that we want to minimize bulges, as described in the previous segments. We have an additional wrinkle here, in that the knot/tape combination absolutely **must** be a smaller diameter than the holes we're going through! That's why we cut off one of the leads, to make sure that's what we'd have once everything was taped and ready to pull in.

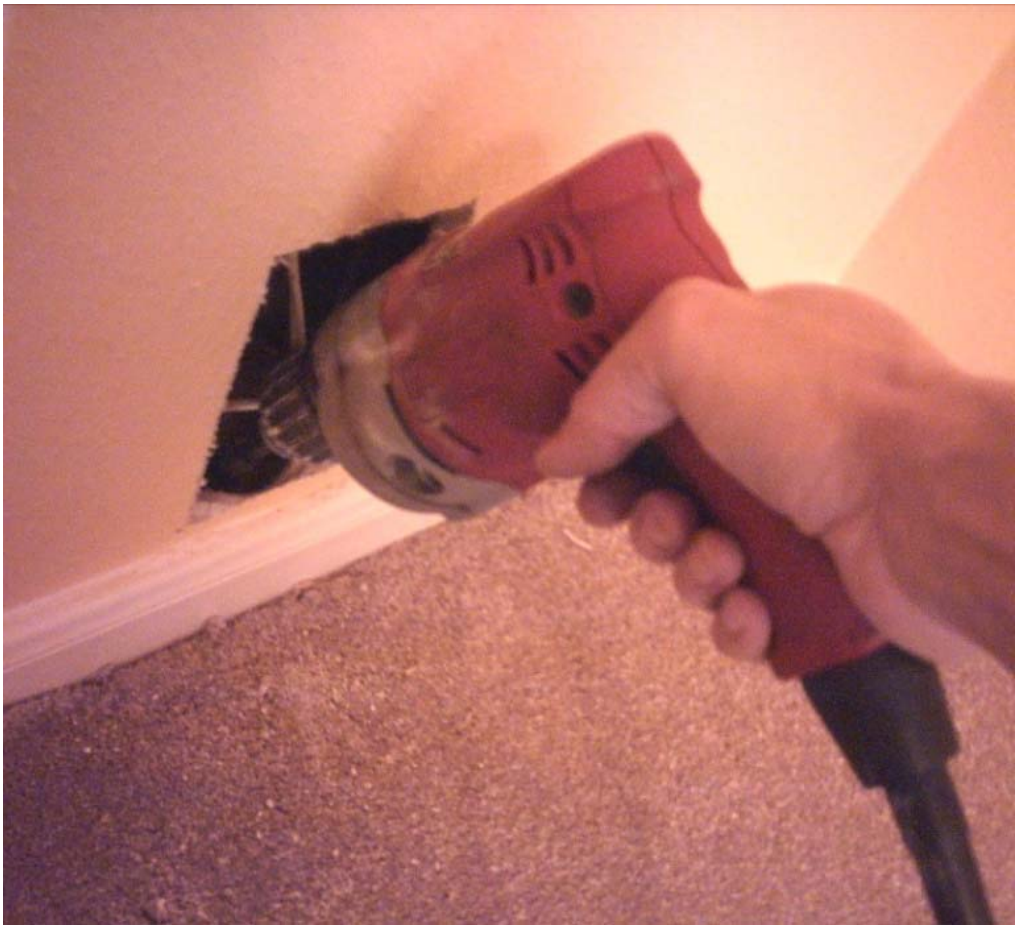
It should be easy now to pull the string hanging from the upper hole, and pull the speaker wire into the lower hole, up the wall and out the upper hole. If your holes are really snug you might want to get someone to feed the speaker wire through the bottom hole while you pull out the top.

The "wireless" method

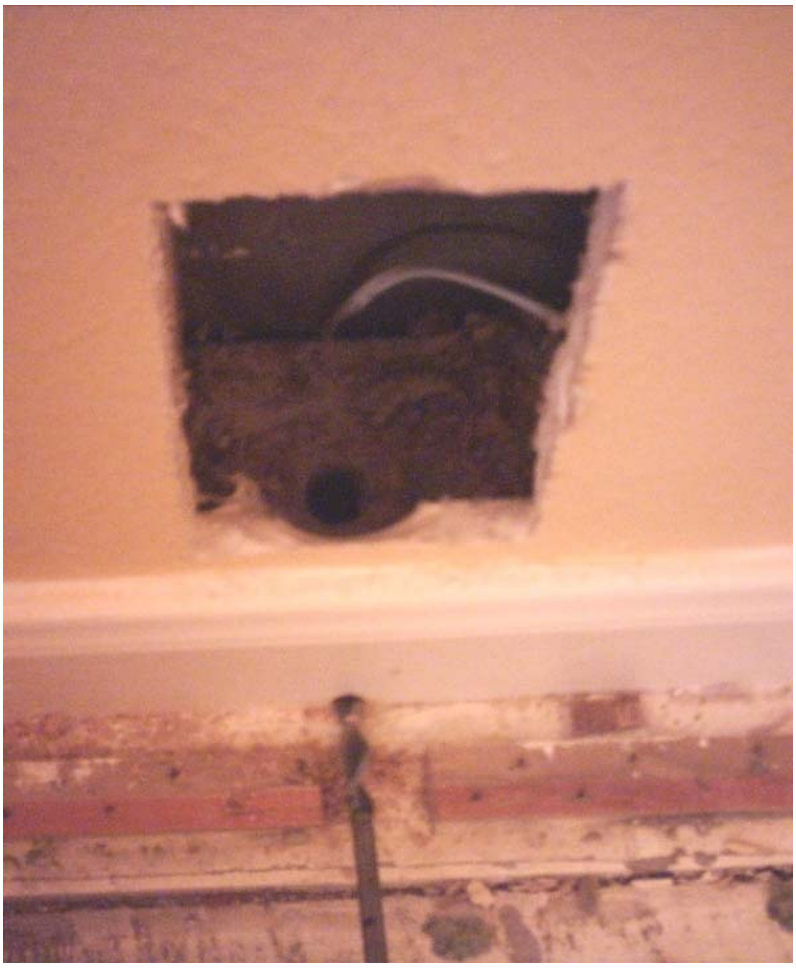
If you're after the clean installation with no wires showing, with the wire going into the wall below the carpet level, it's unavoidable that you'll first have to cut a hole in the wall just above the baseboard. This process is similar to what I described in Part 2, Dealing with a Cross Brace in the Wall, so refer to that segment for clarifications, especially the after-the-fact sheetrock repair.

Once you have your hole cut above the baseboard, you'll see the bottom plate board inside the wall. The problem facing us is that if we drill into the baseboard below the carpet level, the bottom plate is right behind it. So what we need to do is route the wire *through* the bottom plate to get it into the wall cavity. Relax, it's not a tough as it sounds!

Once again we'll call upon our electric drill and 3/4"auger to drill a hole into the bottom plate. If you have a concrete foundation, watch out for bottoming out the auger! You don't want to ruin it, so go slow and stop as soon as you feel some resistance.

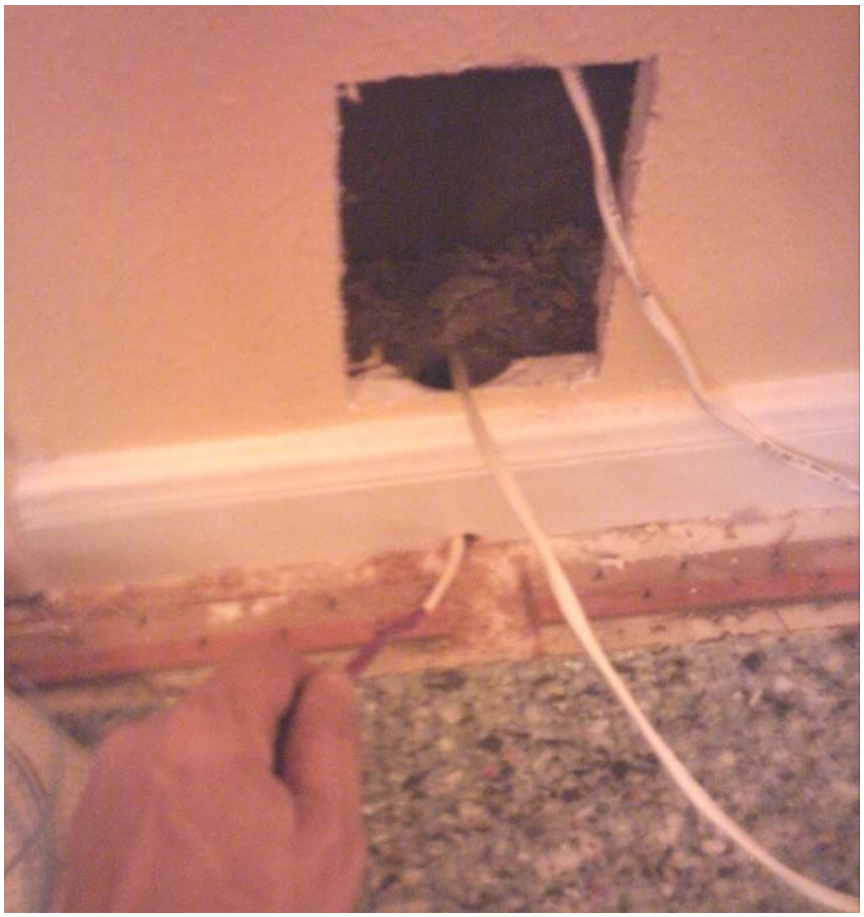


Once the hole is drilled in the bottom plate, pull back the carpet from the wall. Using the 12" or longer drill bit, drill into the baseboard as low as you can. Naturally, you have to make sure you're below the top of the carpet (you might want to mark that on the baseboard with a pencil). Drill into the baseboard directly perpendicular to the 3/4" auger bit hole; you want a "direct hit" into the auger hole.



It should be obvious at this point that the reason a long drill bit is preferred here is so that we can make the hole in the baseboard as straight-on and perpendicular to the larger hole in the bottom plate board as possible. With a short drill bit, the drilling angle will increase, which may result in bottoming out at the foundation before you reach the auger hole. If that happens, you may be forced to move your hole higher, which might make it end up "above grade" and visible. (Note: It is not necessary to notch out the tack strip like the picture above shows. I had to do that because I was bringing the wire out under the carpet from the wall.)

With both holes drilled, tape your speaker wire to the pull string, using the single-lead "U" technique described above. Poke the pull string into the baseboard and pull it out of the 3/4" auger-bit hole with the needle nose pliers. Once you have the pull string you can pull in the wire. With the small holes and sharp bend it'll be slow going, but you should have no trouble getting your speaker wire into the wall. This picture should help illustrate, even though I was routing the wire from in-wall to out-of-wall.



At this point you can follow the instructions given above for the "Easy Method" to get the wire up to where you want it to come out of the wall. Naturally, if you're so inclined you can use a binding-post wall plate up at the speaker location.

Once you have your speaker wire in place, tack the carpet back down and patch the hole in the wall, as detailed in the Part 2 Cross Brace segment.

If you have hardwood floors...

Hardwood or laminate floors are a bit of a challenge. The only options I know of aren't easy or pretty. In the "not pretty" department, you can run your wire in a surface-mounted wire channel product such as Wiremold or Panduit.

I recommend securing the channel to your baseboard with small #4 sheetmetal screws and *not* the adhesive tape wire channel products often come with. Down the road if you ever want to remove it, it's fairly easy to spackle over a small hole and re-paint or stain. Getting rid of adhesive tape residue – total nightmare.

In the "not so easy" department, you can pull the quarter-round or shoe molding and drop the speaker wire into the gap that's typically between the floor and baseboard.

Please address any questions or discussion to this thread. Experienced installers are encouraged to add their own tips!

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01-25-08, 12:04 AM #6

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Part 5: Dropping Wire in a Wall With Insulation

Insulation inside the wall presents yet another installation challenge, but like most others it's mainly a matter of knowing how to deal with it. In this installment we'll cover two common in-wall insulation scenarios: dropping wiring from the attic, and running from the baseboard up to a wall-mounted speaker. Both are variations on what we've previously covered in Part 1 and Part 4 of this series, so it's highly advisable to review those sections to become familiar with the techniques, methods and terms we'll be using.

Tools and supplies

The tools and supplies needed for a from-attic drop will be the same as listed in Part 1. For an up-the-wall-from-baseboard job, the necessary tools and supplies are covered in Part 4. With either method, the only tool you'll need that's not previously listed is an electrician's fish tape. You should be able to get a relatively short one, about 25-50 ft. at any hardware store for about $25-30.

If you don't have a fish tape, or don't want to spend the money for one, a really stiff wire several feet long can be substituted, like the kind they use for hanging ceiling grids. It will need to be bent so that it is slightly curved or arced (the fish tape will already be bent in a rather severe arc).

Oh yes – you can't buy one of these at the hardware store, but a helper is practically a must for this project. ☺

A few considerations before we get started

When dealing with in-wall insulation using a fish tape, it's imperative that you choose a location next to a stud for your entry point into the wall cavity. The exit point into the room is likewise best accomplished next to the same stud.

If you're dropping from the attic to a wall-mounted speaker, a hole in the wall will be required, large enough to get your hand and forearm through to grab hold of the fish tape we'll be using. Thus, you do have some leeway if you need the speaker to be some distance from the stud, but the hole will have to be close enough to the stud for you to touch it when you reach your hand inside the wall. An old work electrical box with a blank cover can be used to dress out the hole, as described in the second post of Part 1, "Finishing details" heading. (Proper installation of old work boxes was covered in the first post of Part 1 under the "Finish in-room preparations" heading.) Or, you can use a binding post wall plate if you prefer (personally, I don't like them – too many extra connections required). If you are going for the clean look of the direct-out-of-the-wall method described in the second post in Part 1, some after-the-fact sheetrock repair will be required, as detailed in Part 2, Dealing with a Cross Brace in the Wall.

If you are running your wiring up from a baseboard, it's a bit difficult to use the direct-out-of-the-wall method at the speaker location, but it can be done. However, a large hole will be required at the bottom of the wall, along with either an old work box and blank cover, or a sheetrock patch job.

Naturally, if you're doing a drop from the attic to behind the equipment rack, an old work box is what you'll want.

Dropping from the attic

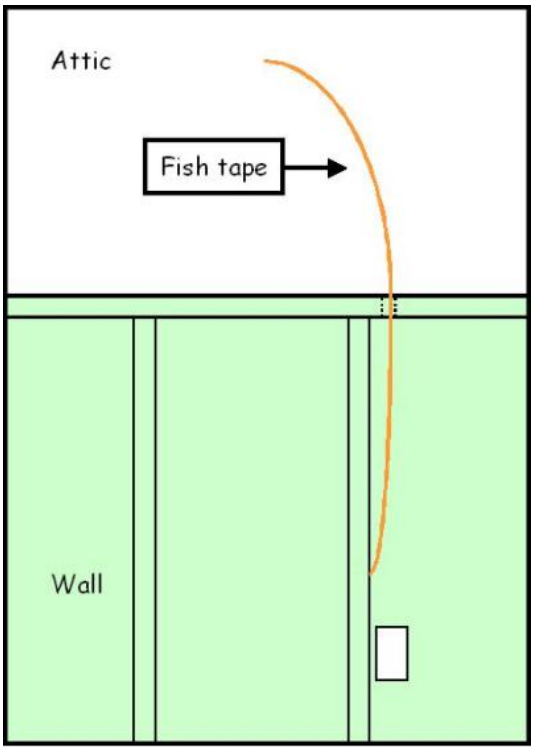
For a drop from the attic, the first step is to use your stud finder to locate a stud close to your desired location (for both wall-mounting speakers or coming out behind the equipment rack). Move over an inch or two from the stud and poke your 90° bent coat hanger into the ceiling. In the attic, locate the coat hanger and drill a hole in the top plate with your drill

equipped with a 3/4" auger bit.

If you have a fish tape similar to what's pictured above, spool off enough length to reach to the bottom of the wall (or the wall-mounted speaker location, if that's where you're going). Notice that the end is back fully 180° (see picture above). This gives it a smooth, blunt end that will be less prone to snagging the insulation.

Here's where it gets a bit tricky: Once the 3/4" hole is drilled in the top plate, push the fish tape (or slightly curved stiff wire) down the hole so that the curvature is angling *towards the stud* inside the wall. This will serve to apply pressure to keep the leading end against the stud as you feed the fish tape down the hole. The idea is for the fish tape to "chase" the stud all the way down the wall and end up perfectly at your access hole inside the room. The pressure from the curvature of the tape will help keep it "riding" the stud.

Here's a crude drawing to hopefully illustrate what we're talking about.



If we had tried to drop the fish tape at a central location between the studs, it's hard to predict where it will end up. Since it has a natural curvature, it will not pierce very far through the insulation, but will merely bunch up in loops inside the wall. I've even had the end of the fish tape come right back out of the 3/4" hole – no kidding!

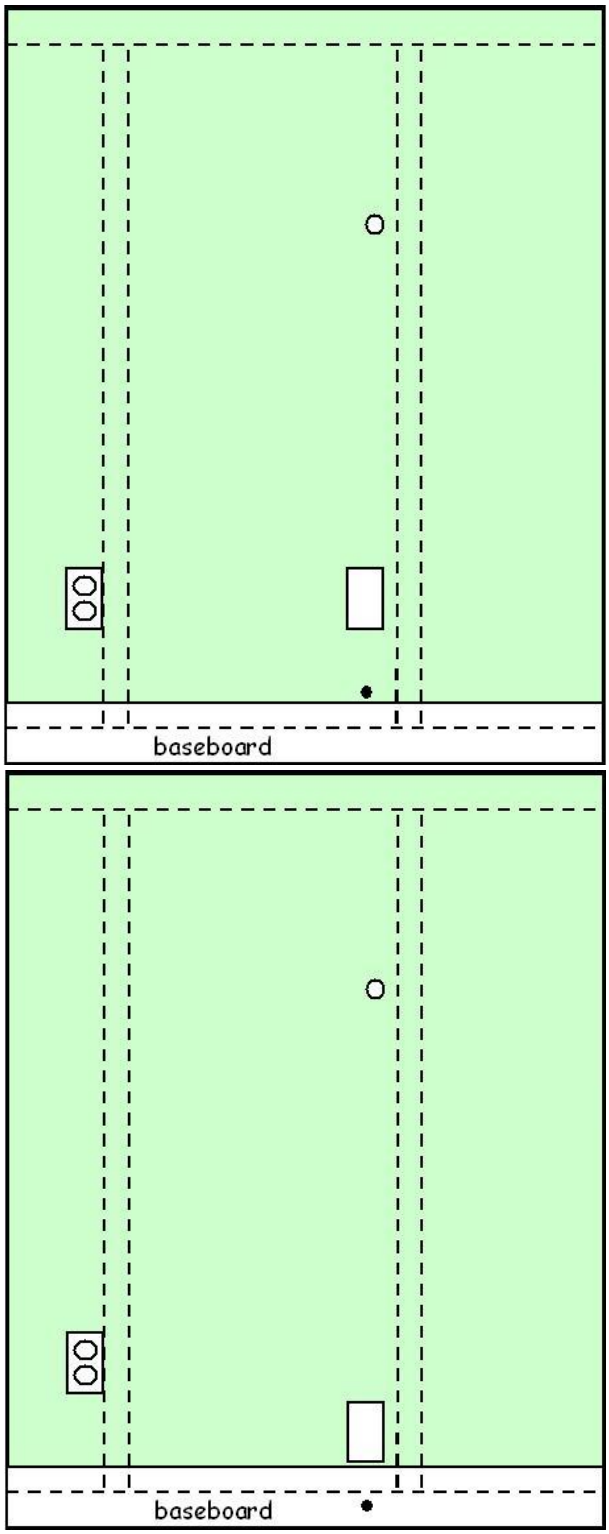
Once you get the fish tape down the wall to its destination (it might take a couple of tries to accomplish), your helper can reach inside the access hole and pull it out. At that point a pull string can be taped to the fish tape and pulled back up to your location in the attic. Once the pull string is in place you can pull in your wiring. Afterwards, you can deal with any holes in the wall, as discussed in Part 1 and Part 2.

Wiring up the wall from baseboards

As we discussed in Part 4, there is an easy way and a difficult way to accomplish running speaker wire up from the baseboard to a wall-mounted speaker, depending if you want the wire to be totally hidden or if you don't mind a short length being visible between the carpet and top of the baseboard.

As with a drop from the attic, the first step is to locate a stud with the stud finder. If you're going with the "easy" above-the-baseboard route, cut a hole in the sheetrock for an old work box at electrical outlet height directly above the point where you want the speaker wire to enter the wall. Up at the speaker location the easiest thing to do would be to use another old work box, although you should be able to work through a hole just large enough for the fish tape if you prefer the "direct out of the wall" method described in the second post of Part 1. For the "hard" method, entering the wall through a hole drilled into the baseboard, your hole in the wall (that will have to be patched later) will be just above the baseboard.

To better illustrate, here are a couple of drawings showing the locations and alignments of the entry, access, and exit holes for both methods. The small upper exit hole depicts the "direct out of wall" option; a larger hole for an old work box can be used there instead. Naturally, the dashed lines show the interior wall construction – studs with top and bottom plates.



Above-Baseboard Method (Easy), Through-Baseboard Method (Hard)

Once all the holes are in place, we're ready to use the fish tape. As we described with the attic drop, the idea is to make the tape "chase" the stud from point A to B, so as to not get "lost" somewhere in the insulation. If you're using old work boxes both down low and up high, it should be pretty easy to accomplish, as you have plenty of room to maneuver the fish tape. It probably doesn't matter if you run the fish tape from the lower hole or upper, but I think it's easier running it down from the top hole.

If you're trying for the "direct out of the wall" method with a small upper hole, how you drill the hole will probably make of break your chances of success. For instance, if you drill your hole straight into the wall, the fish tape has little chance of "chasing" the stud down the wall as we've described. Therefore your best bet will be to drill the hole with a hard downward angle, and slightly angled towards the stud. This should be sufficient to induce the fish tape to "chase" the stud down the wall when you push it into the wall.

Once you get the fish tape down the wall (again, it might take a couple of tries to accomplish), attach the pull string, pull your wiring into the wall and deal with the holes as discussed in Part 1, and Part 2.

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