



Installing and Using In-Wall Speakers





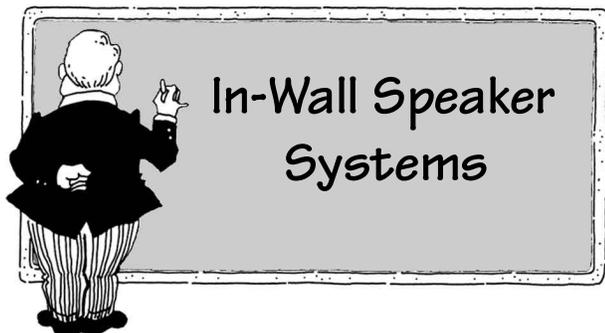
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In-Wall Speaker Systems

Close your eyes and travel back in time to your high school days. Remember those round, perforated speakers mounted high over head that crackled the principal's morning address? Well, back then that was the primary application of "in-wall" speaker product: high volume, low-fidelity sound amplification.

Today, things are different. In-wall speakers are still used for sound amplification, but a new category of high performance models have evolved, providing the foundation for the new "unobtrusive audio" design philosophy.

Unobtrusive audio refers to the popular desire to minimize audio equipment visibility in the home and simplify its usage. The problem: traditional audiophile components, such as rack electronics, cables and freestanding speakers, tend to dominate rooms. This may not be an objection for the family audiophile, but it can be for the other members of the family with aesthetic sensibilities (read: typically your spouse or your roommate).

Manufacturers have sensed this conflict and have responded by producing "architectural" or "designer" lines of audio equipment. The unifying philosophy continues; reduce clutter by offering products that can be built physically into the structure of the building and thus out of sight. In the case of speakers, this means into the walls (or ceilings, floors, etc.)

Today, in-wall speakers are offered by a large number of manufacturers. They are available in a plethora of designs and styles, many customized for specific applications,

such as audiophile-quality home theater rooms. This article offers an overview of some of the current in-wall speaker offerings, and discusses the benefits and liabilities of their use. The emphasis is on the do-it-yourself, so we continue by discussing placement issues and finish with a step-by-step illustration of an in-wall speaker installation.

Where To Use 'em?

In-wall speakers can be used in almost any application where audio sound reproduction is desired, but practically speaking they tend to find themselves in one of two general applications.

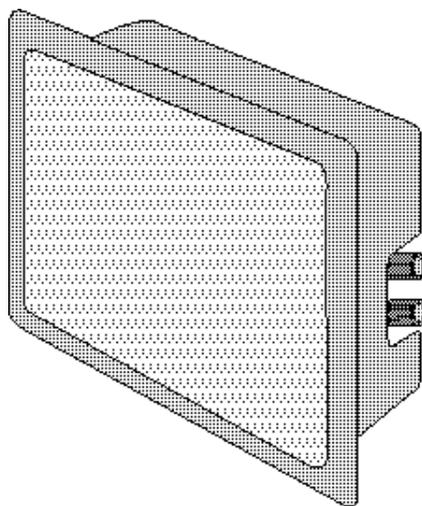
Casual listening. The vast majority of in-wall speakers find themselves pressed into the background music reproduction business. These speakers are usually installed where they look good (or can't be seen at all) for example: kitchens, dining rooms, bathrooms and the like. As a result, traditional audiophile criteria, such as imaging, frequency response and

power handling capability, are not of primary importance for the users of these speakers.

Home Theater. This venue has almost diametrically opposed performance criteria. In most home theaters, enthusiasts want the finest audiophile-quality sound. Actually, what they really want is all the attributes of high performance, freestanding speakers without having a room filled with boxes and wires.

This is a good example of an application that in-wall speakers are uniquely suited for; a high performance, yet aesthetically pleasing audio environment. They are especially useful

as in-line surrounds.



The Pros and Cons

Many audiophiles hold the opinion that in-wall speakers constitute poor cousins to their free standing counterparts. After all, if one of the most important parameters of speaker design is the cabinet, how could a bunch of open-backed drivers stuffed into a wall sound any good? In reality, there is a shred of truth to this, but the situation is not that simple. Like other audio components, in-wall speakers have advantages and disadvantages, but properly installed, they can provide excellent quality sound reproduction. Let's take a look at a few of their strengths and limitations.

One of the disadvantages of installing open-backed

speakers into a wall is the infinite baffle characteristics of the speaker/wall combination. It becomes more difficult to control the acoustics of a speaker when the enclosure characteristics, such as a wall stud bay, are uncertain. The manufacturers of in-wall speakers have compensated for this uncertainty with driver characteristics, such as stiff suspensions and reduced voice coil travel. Optimizing these characteristics have produced speakers that sound quite good. However, others have chosen to avoid this route and offer their in-wall speakers with integral, sealed enclosures.

The difference in sound? It depends on the manufacturer and it depends on the speaker. We suggest that you listen to several different models before you buy.

It should be noted that in-wall speakers do differ from freestanding models in another significant way; the ability to tune the room/speaker response by moving them around the room. Obviously, once you have installed in-wall speakers, it isn't easy to move them around for listening tests.

A major advantage of using in-wall speakers is the elimination of edge diffraction distortion. As a physical principle, diffraction occurs when sound waves flow around a discontinuity (i.e. sharp edge). The biggest source of diffraction in a free standing speaker are the edges of the cabinet itself. Since they do not have cabinet edges, in-wall speakers do not suffer from this distortion.



Variations On A Theme

The standard in-wall speaker is a relatively simple affair. It consists of a baffle that holds the drivers and crossover, a frame and a painted metal grill. The whole assembly is designed to be securely mounted in a hole cut into the wall, or to a frame that is fastened to the building studs. The actual mounting technique differs according to the manufacturer but generally can be described as either mounting directly to the wall surface via clamps, or mounting to a frame secured to the wall studs. Our diagrams in the do-it-yourself section will help you to visualize this.

Most in-wall speakers use conventional cone and dome drivers fall into the category of two-way systems. In other words, the speaker uses a woofer for bass and mid-range

frequencies, and a tweeter for the higher frequencies. An electrical crossover divides the signal between the two drivers and, in design, can be as basic as a single capacitor, or as complex as the intricate multipole designs in the more expensive models.

A small minority of in-wall speakers have been designed with an integral "back box" that essentially makes them acoustically sealed enclosures. Companies such as Cambridge SoundWorks, RBH Sound, and Triad offer sealed enclosure speakers. In the case of Cambridge SoundWorks, the sound of their Ambiance In-Wall is designed to closely emulate the performance of their popular Ambiance free standing model.

Taking this philosophy a little further, In-Wall Audio offers a line of in-wall speakers that are engineered to perform like large, freestanding speakers. These large, rectangular units are designed to be built between the wall studs and thus be completely enclosed by the finished walls.

Many manufacturers offer in-wall speakers that are specially designed for bass reproduction. The most common are standard baffle designs with one large woofer and a crossover that limits the input signal to the bass frequencies only. AES offers a variation for those who desire just one subwoofer in their stereo system, a speaker with a single woofer with a dual voice coil. The operative principle here is that both the right and left channels can be connected to a single

subwoofer. This type is ideal for folks on a budget or those who don't have the room for two in-wall subwoofers. Another sub-woofer variation is offered by MTX who has an "In-Floor" speaker. Their FS-8A and FS-10A are designed to be placed either low on a wall, or in the floor, and fires through a thin, unobtrusive grille.

Another trend is tilting, or angled tweeters. These speakers address the fact that higher frequencies are more directional than lower frequencies, and the installer can thus optimize the speaker's dispersion characteristics by pointing the tweeter towards the listeners. AES, Apogee, Martin-Logan, MTX, Phase Technology, Sonance and Triad are some of the companies that make speakers with adjustable tweeters. Another option for the discriminating listener is high performance ribbon tweeters. Infinity, a/d/s, Apogee and Martin-Logan are a few examples of manufacturers who

integrate them into their speakers.

Everyone knows that bathrooms are frequently clouded with steam and because of this are an inappropriate places to mount audio equipment, right? Well, to quote a popular TV commercial, "Not exactly". Some manufacturers offer in-wall speakers that thrive in humid environments. For example: New England Audio Resource (NEAR) manufactures an metal-alloy driver, all-weather speaker designed for such environments. It can they can even be mounted right in a shower stall. Niles also offers an all-weather models.

A popular debate these days is which speaker configuration is best for the rear surround channels in home theaters. We won't delve the arguments here, but those who side with the THX "dipole camp" have been forced to suspend bulky freestanding dipole speakers from their home theater walls.

Not any more. Several manufacturers now offer genuine dipole surround in-wall speakers. For example: Triad offers an in-wall version of their THX certified 'On Wall Silver' 2-way dipole speaker. This speaker features two 5.5" polypropylene woofers and two 1" dome tweeters and retails for around \$1000 each. Snell Acoustics offers their SUR 800 3-way, in-wall surround for about \$1399. Atlantic Technology offers a audiophile quality, yet highly affordable in-wall surround speaker. Their 254.1SR surround speaker has two 4" woofers, two 1/2" mylar tweeters and retails for \$399 a pair!

Your Place or Mine

The placement of any speaker, whether they are free standing or in-walls, can affect the quality of the sound you hear in a listening environment. As we mentioned before, the ability to experiment with placement does not occur easily with in-wall speakers. Let's look at a few rules of thumb so you can choose the best location for the speakers the first time around.

If you are placing in-wall speakers in a room where background listening is the norm, the location of your speakers can be driven by aesthetic criteria. There is nothing wrong with this. After all these are "designer" products. However, during your system's design phase, you may want to consider a few basic audio dos and don'ts to maximize the quality of the sound.

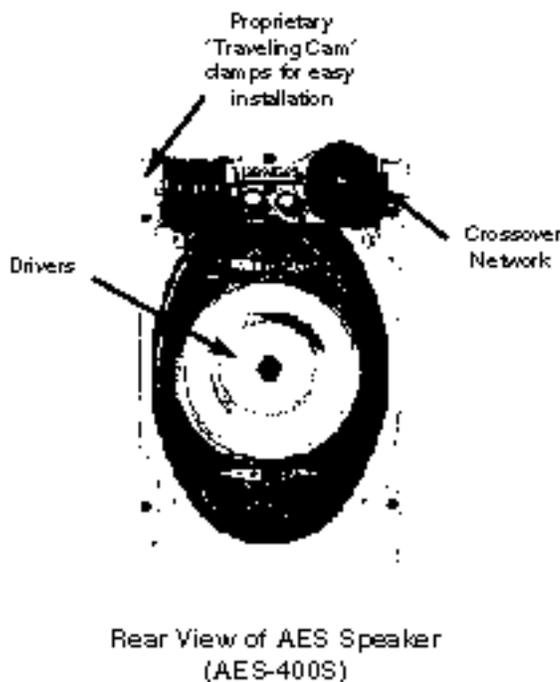
First, if you can, mount the speakers somewhere around ear level or slightly higher. It is best for the listeners to receive a substantial proportion of the sound directly from the speaker, as opposed to sound reflected from room elements. Next, try to stay away from perpendicular walls. If you put a speaker near an acoustically reflective surface, the sound bouncing of the wall can interfere with the directly radiated sound waves and produce comb filtering distortion. Finally, if you place the speakers symmetrically in the listening environment, you can optimize the stereo effect.

If you are placing in-wall speakers in a home theater, the placement of the speakers is very important, especially if you are building a home theater to comply with THX specifications. Lets consider the front speakers first.

Ideally, it is best to have left, center and right speakers of the same type and aligned in a horizontal line through the middle of the video image. Unfortunately, this is not possible in most home theaters because the front speaker needs to go right smack in the middle of the picture. The next best position is to flank the television, or video screen, with the left and right speakers, and install the center channel either above or below the picture. The diagram illustrates this. (Note: for those that are building high-end home theaters with front projectors, several screen manufacturers offer perforated acoustically transparent

screens so that speakers can be placed directly behind the screen.)

There are several schools of thought about the type and placement of surround speakers, but the most popular is to place the speakers so they are flanking the audience seating area, above the listener's ear level. You may want to do a little reading on the subject of home theater design before you decide exactly where your surrounds should be installed.



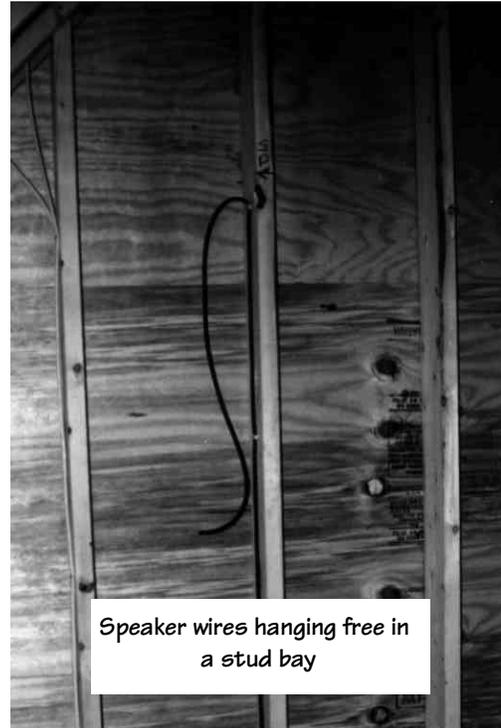
Rear View of AES Speaker (AES-400S)



Audio manufacturers generally design their in-wall speakers for ease of installation in both new construction and existing structures. The typical in-wall speaker mounting technique is not difficult, and is well within the realm of the average do-it-yourselfer. However, the challenging part is not the speaker mounting itself, it is the necessary preparation that occurs beforehand. This preparation varies greatly depending on the building structure itself, and whether you are installing the system in a building as it is being built (new construction) or an older, existing building.

New construction. The obvious advantage of installing in wall speakers in a building during the construction phase is that you can "prewire" the speaker cables into the walls. This saves an enormous amount of time compared with snaking them through the structure post-construction.

The general prewiring method starts with visiting the site just after the framing is completed and deciding roughly where you want the speakers to be mounted and the audio equipment located. Next, you run the speaker wires from audio equipment location, up to the stud bays where the

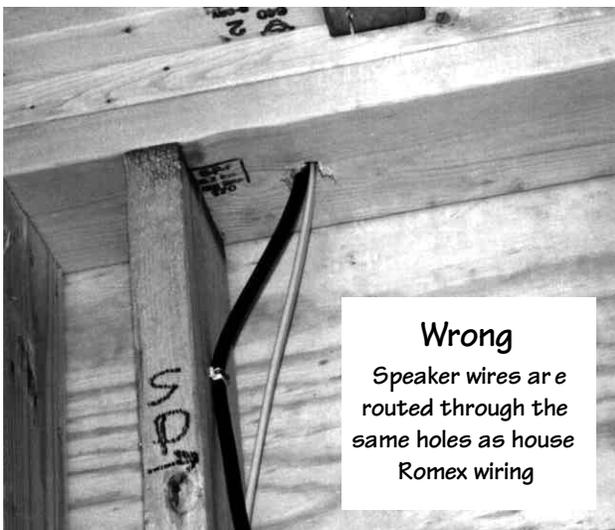


Speaker wires hanging free in a stud bay

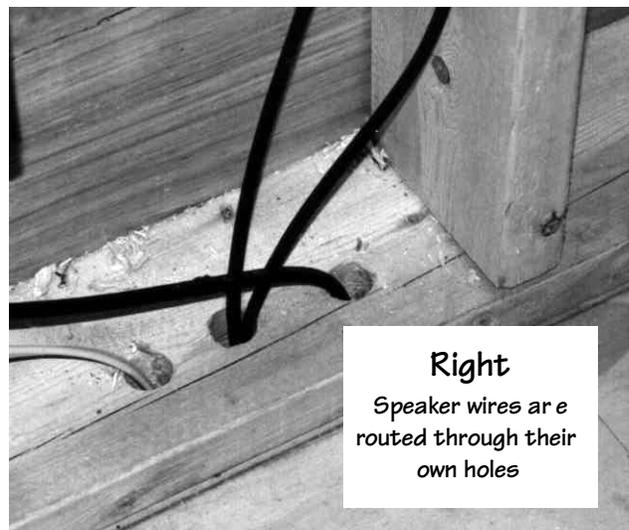
speakers are to be mounted. Do this through 1/2" holes drilled in the center of the framing members (see photos below for a visual tutorial on how to route A/V wires. Bottom line: don't run them next to 60hz power wires or you are asking for interference problems).

Let a length of speaker wire hang down free in each bay (see photo above).

Another thing many installers do is draw a diagram of the



Wrong
Speaker wires are routed through the same holes as house Romex wiring



Right
Speaker wires are routed through their own holes

room and indicate the distance from the wires to the nearest reference wall. This makes finding your buried wires (and studs) much easier when you come back later to install the speakers.

Old construction. The process of installing in-wall speakers in an existing building can range from a simple exercise, that is not much worse than in a new building, to a great deal of work. You may want to assess the work involved if you plan to install an extensive system in an older house. Remember professional installers do this all the time and they know all the shortcuts and tricks of the trade. You can achieve the same results, but it probably take a lot more time.

Let's have a serious talk about snaking. Snaking is the colloquial expression for the seemingly impossible task of getting things from point A to point B through the structure of an existing building. You know it's going to be interesting when point A is in the basement and point B is the master bedroom, and you want to pull a coax cable between the two with the cable hidden completely from view.

Many home construction and repair professionals are expert snakers. In particular, electricians, alarm technicians and A/V custom installers do it virtually every day, and as you might imagine, are really good at it. For the do-it-yourselfer, though, snaking comes a little harder. After all, learning to snake is an experiential process. The first few times are typically challenging, but after that most do-it-yourselfers have the hang of it. The main ingredient necessary is just a good dose of patience (try this as you are working: picture the dollar bills you are saving every hour, gently floating by and accumulating into a big pile. This is what we do.)

Note: if the structure is less than 50 years old, the walls most likely consist of gypsum-based wall board. This substance is easy to cut with a drill and a keyhole saw. If the house is older, you may find plaster and lath wall construction. Cutting a hole in this material is tricky because it is often old and dry, and crumbles when you cut through it.

Now, let's take a look at a typical in-wall speaker installation step-by- step. In this example we are installing an in-wall speaker in a first floor room and snaking the speaker wires up from the basement. Some of the tools you will need are: a 3/8" or larger electric drill, an electric saber saw, installer's drill bits (long, 1/2" to 5/8" drill bits), a standard wire snake and a sharp utility knife.

Step One:

Decide approximately where you want to locate the speaker in the family room. We emphasize approximately because you may have to move them over several inches if there is an obstruction (like a wall stud) behind the wall. Mark the

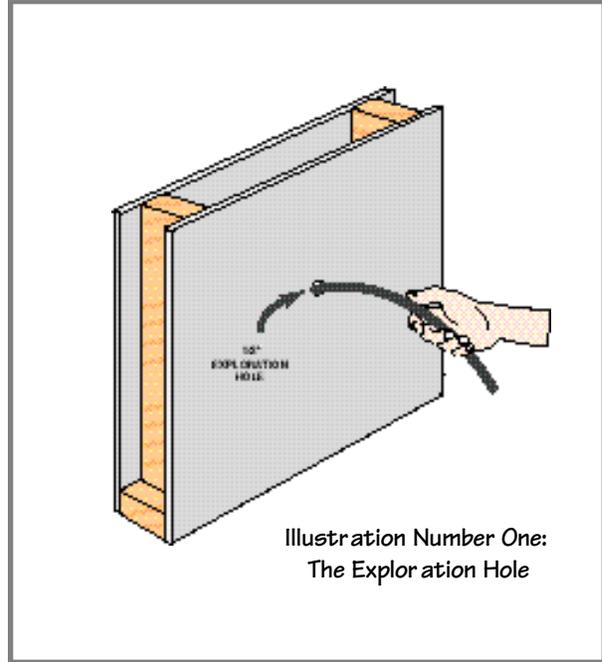


Illustration Number One:
The Exploration Hole

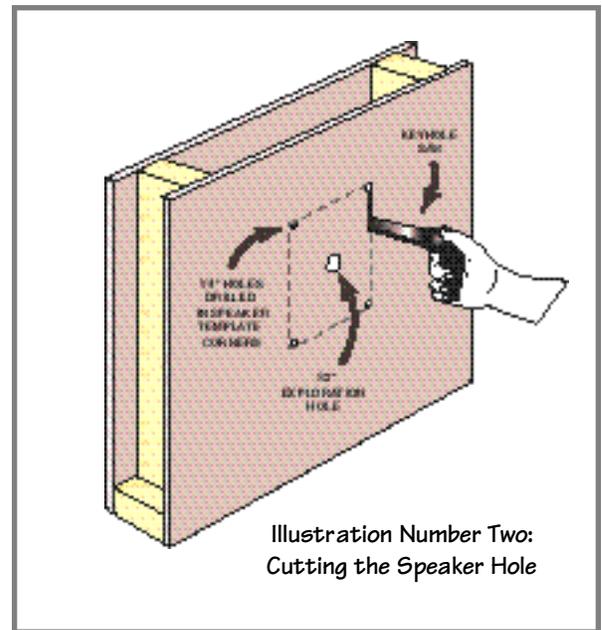


Illustration Number Two:
Cutting the Speaker Hole

location.

Step Two:

Find out what is behind the wall in that spot. The standard method employed by custom installation professionals is to tap horizontally across the wall surface and listen for the dull reverberation of supporting wall studs. (You can also use an electronic stud finder). Once you have the approximate location of the studs, drill a 1/2" exploration hole in the center of the bay (between the studs) stopping as soon as the drill perforates the back side of the front wall surface. As Illustration number one shows, this hole allows you to insert a snake wire into the wall cavity and verify where the studs are located by probing around.

Step Three:

Cut the speaker mounting hole. Once you know where the wall studs are located, you can put the speaker's paper template (supplied with most in-wall speaker models) against the wall and draw the cut-out pattern. Hopefully, this is close to the spot that you originally wanted to install the speaker.

Before you actually begin cutting the hole, double check all your measurements. It is far better to find an error now than after the power tools have had their way. If everything looks right, start by carefully drilling a 1/2" hole in all four corners of the speaker template tracing. Then using a key hole saw, slowly cut from corner to corner and remove the cut out wall section. Illustration number two shows this procedure.

Step Four:

Drill a hole up into the stud bay. A stud bay is a carpenter's term for the area between any two 2x4 wall studs. In our example, we are installing an in-wall speaker in a first floor stud bay and snaking wires up from the basement. The first thing to do is pinpoint the location of the stud bay overhead on the basement ceiling. This is easily done if you take several measurements in the room above and apply them to the basement ceiling. Be extra careful with these measurements or you could find yourself in drilling into unintended areas, such as hardwood floors, etc.. Illustration three shows a successful penetration into the stud bay.

Step Five:

Snake the speaker wires through to the speaker cut-out. Insert the end of a wire snake into the hole you just drilled. The object is to twist and probe your way

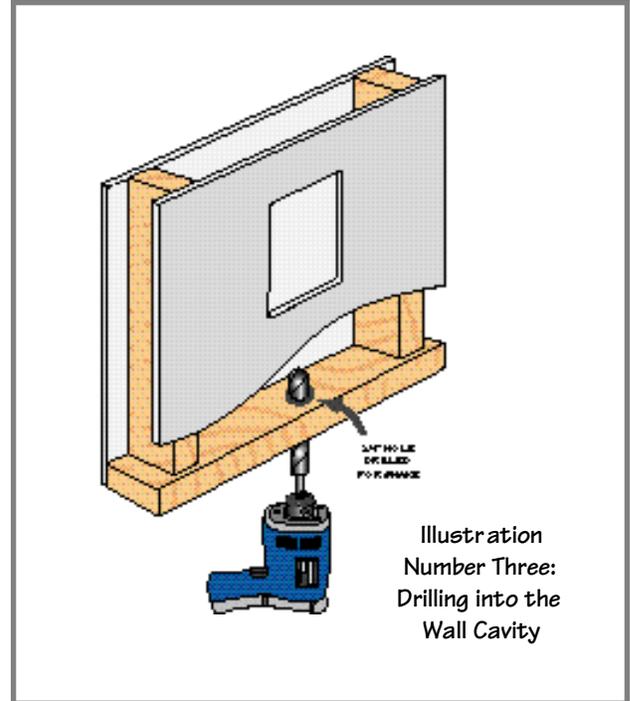


Illustration Number Three: Drilling into the Wall Cavity

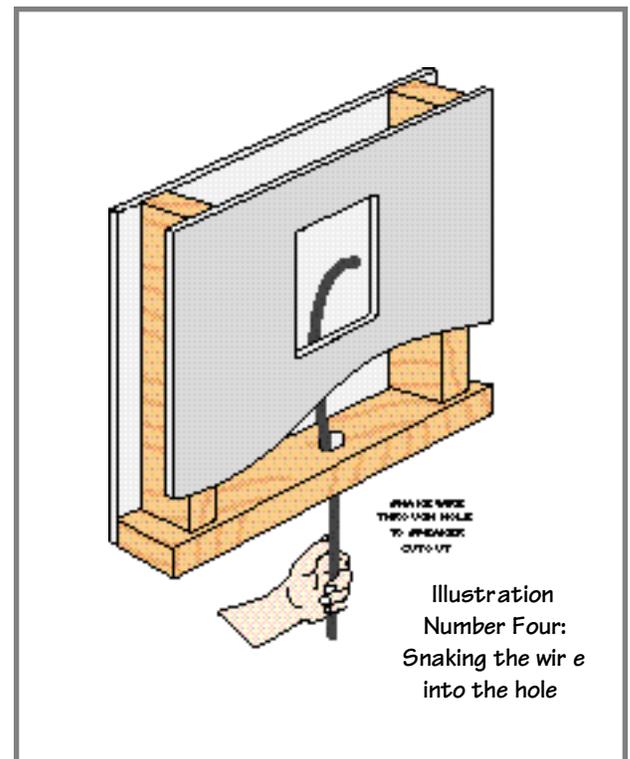


Illustration Number Four: Snaking the wire into the hole

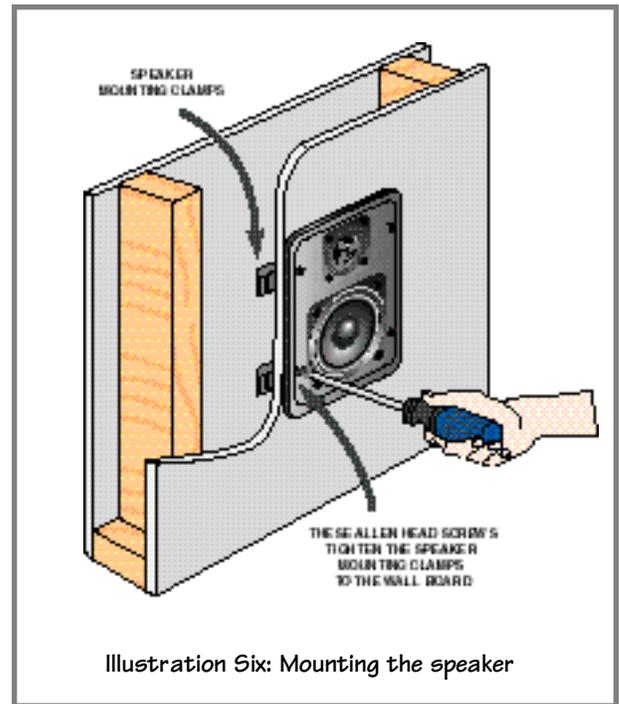
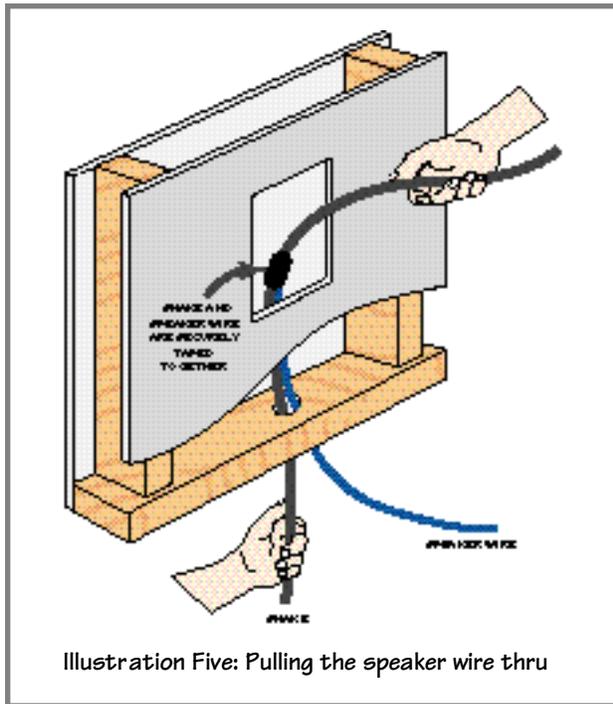
up the wall section until it appears in the speaker cut-out (see illustration four). At this point, having an assistant upstairs looking into the speaker cut-out can be helpful.

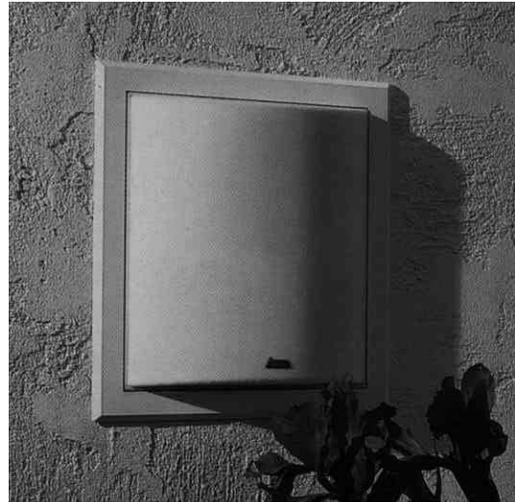
Step Six:

Use the snake to pull the wires up through. Once you have successfully pushed the snake wire from the basement to the cut-out, you can tape the speaker wires securely to the snake (use electrician's tape) and pull them through from the basement to the cut-out hole (see illustration five).

Step Seven:

Mount the speaker in the wall cut-out. Congratulations, the snaking is done. Now, you can attach the wires to the speaker and follow the manufacturer's suggestions for mounting the speaker in the cut-out hole.





Atlantic Technology's 254.1 Surround Speakers Are DiPolar But Are Designed To Be Mounted In-Wall With Optional Wall Mounting Brackets

NOTES:

