

INSTALLING Home Theaters



Home theater equipment is one of the hottest-selling categories of consumer electronics. Most homeowners buy separate electronic components

and wire them to freestanding speakers and a big TV. But when the budget allows, it's preferable to build this equipment into the house. Not only does a built-in system perform better,

but the equipment is concealed.

As a general contractor, you're unlikely to install theaters yourself. But if a client wants one, you'll have to coordinate the work of the trades that are involved. My company designs and installs home theaters; in my experience, the quality of the finished product is strongly affected by the GC's ability to manage the job.

by Steve Ehram

The room provided by the GC is as important
as the equipment that goes into it

Home Theater Defined

A home theater is designed to replicate the experience of watching movies in a commercial theater. It consists of a

viewing screen, multiple speakers, and source equipment such as DVD players, amplifiers, and high-definition satellite receivers. However, a theater is more than a collection of electronic components; it's a system that starts with the room itself.

High-end projects may include rooms specifically designed for viewing movies. Clients with less space and lower budgets are more likely to integrate the equipment into multi-use areas such as family rooms. Regardless of the budget, the rooms will contain similar components and the same design principles will apply.

Figure 1. Soundproofing is important in the walls of a home theater. Here, a partition wall has been insulated to limit the amount of sound that reaches the adjoining room.



Sound Isolation

Sound isolation is an important part of any theater. Outside noise distracts the viewers, while escaping sound may disturb the neighbors or other people in the house.

The simplest way to sound-isolate the room is to insulate the stud bays (see Figure 1). It's fast and cheap but only somewhat effective. A better way is to double-frame and insulate the walls using extra-wide plates and offsetting studs so the inside drywall is fastened to different studs than the outside drywall. Sound transmission can be further dampened by separating the wall and ceiling planes from adjoining surfaces by holding the drywall back from the inside corners and caulking rather than taping those joints.

Another way to isolate surfaces, including floors, is to install them over gaskets, isolation channels, or sound control membranes. Walls can also be isolated by installing sound absorption material like Acoustiblok (Tampa, Fla., 813/980-1400, www.acoustiblok.com), a heavy, flexible material that comes in 1/8-inch-thick sheets. Installed behind the drywall, it blocks 26 decibels of sound, which means there will be almost no sound transmission. Special care must be taken to maintain tight seams and close fits at penetrations for lights and ductwork. The installed price for this product is about \$15 per square foot, so we use it only as a last resort.

Room Acoustics

Excellent sound quality distinguishes a home theater from a room with an oversized TV. Though you can spend hundreds of thousands of dollars to acoustically engineer a room, we mainly deal with acoustic issues by using sound-absorbing materials and by varying the size and shape of the room.

One basic rule is to avoid putting theaters in square rooms, which tend to suffer from dead spots, reverberation, and other audio problems. These are less likely to occur in a rectangular room and least likely in a room that's irregularly



Figure 2. Pilasters, soffits, and ceiling trims not only look good, but also enhance audio reproduction in a theater by breaking up large flat surfaces.

shaped. The sound is better if large flat surfaces are broken up with architectural elements such as soffits, pilasters, and niches (Figure 2, previous page).

Ceilings should be between 8 feet and 14 feet high. Rooms any taller will suffer from a “church” or “hall” effect. If the ceiling is over 14 feet, it’s important to outfit the room with sound-absorbing materials such as heavy drapes and upholstered furniture.

The room will sound better if you minimize the number of hard, reflective surfaces. Carpet is by far the best flooring material to use in a theater. Wood is a distant second, and tile comes in last. If clients don’t want carpet, they should be prepared to put down a lot of rugs. Ideally, walls should be covered with soft, nonreflective material. The walls of high-end theaters are frequently upholstered (Figure 3). A less expensive option is to use heavy drapes or wallpaper made of textured fabric.

A/V Wiring

The first thing our installers do is run audio-and-visual (A/V) cable around the room. It’s important to coordinate this work with the electrician’s because electrical wiring generates an electromagnetic field that can degrade the performance of the theater. Try to keep A/V cables at least 24 inches away from parallel electrical wires. If the wiring is closer, the theater may suffer from picture ghosting and audio distortion. If you’re forced to cross an electrical wire, it will cause less interference if you do it at a 90-degree angle (Figure 4).

You need to get it right the first time because wiring problems may not show up until the house is finished and everything is plugged in. At that point, it’s hard to diagnose the cause without tearing open walls. For that reason, we prefer to run A/V cable after the electrical wiring is in (Figure 5).

A/V wiring should be rated for in-wall applications and matched to the components being used. If the run is longer than 100 feet, you may need to



Figure 3. Theaters should contain a lot of sound-absorbing material such as carpeting, stuffed furniture, and heavy drapes. Upholstered panels have been added to the walls and door of this high-end dedicated theater.



Figure 4. Ideally, A/V cable would never come within 24 inches of electrical wire. If they have to run parallel, keep these wires apart. If a cable has to cross an electrical wire, do it at a 90-degree angle as shown.



Figure 5. The electrician ran this Romex when no one was looking. It shouldn’t be in with the A/V cables and will cause interference if it’s not removed and brought in separately from below.

use a larger conductor. Some entry-level speakers won't accept anything heavier than 16-gauge wire. Using something thicker may force your client to spend more for the speakers.

Speaker Locations

Surround sound is one of the distinguishing characteristics of a home theater. It's much more realistic than sound that comes from a single source.

The current theater standard is to use six speakers: three in front, two in back, and a subwoofer (Figure 6).

The location of the speakers determines how the theater will sound. The three front speakers should be in the same wall as the screen and pointed directly at the viewers. One speaker should be centered on the screen. The left and right speakers should be in the same plane as the center speaker and

far enough away that they form about a 45-degree angle with the center-most viewer. Rear speakers belong at the back of the room, pointing down from the ceiling or in from the side walls. The subwoofer is specifically designed to be placed in a corner.

It's important to determine speaker locations in advance so that carpenters can provide open bays and mechanical contractors can keep their equipment out of the way (Figure 7).

Speaker Layout

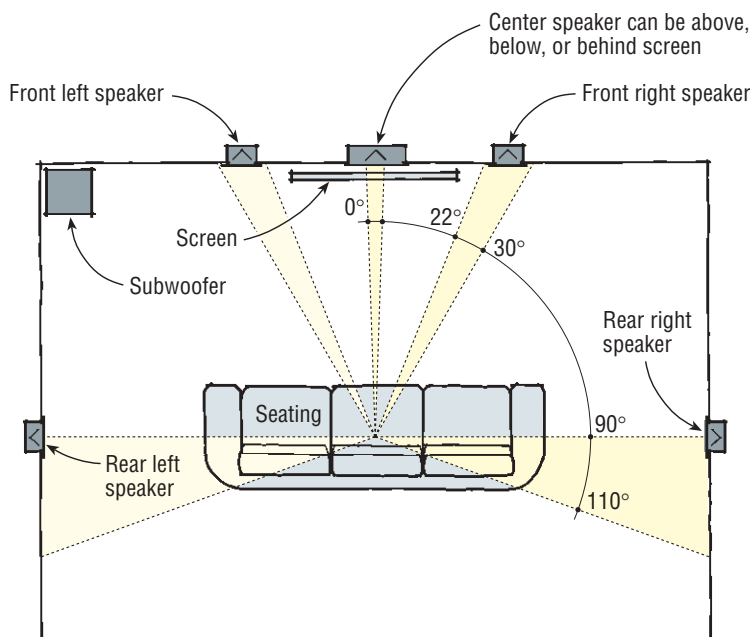


Figure 6. Most theaters have 5:1 audio systems: three speakers in front, two in back, and a subwoofer in the corner. The front speakers are usually hidden behind fabric grilles, and the rear speakers are mounted in the wall or ceiling.

Concealing Speakers

Most clients don't want to see speakers, so we hide them in the walls and ceiling. Some speakers mount flush to the drywall, so all that's visible is a metal grille (Figure 8). We typically use these speakers at the back of the room, where they'll be less noticeable. Most architects prefer to put ceiling speakers in line with recessed lights. This location may look better, but it probably won't produce the best sound.

A common technique for concealing speakers is to put freestanding speakers in framed wall niches covered with sound-permeable fabric. The viewing screens for front projection systems

Figure 7. A lot of things get built into the walls and ceiling of a theater, and you need to know where they are in advance. This mounting bracket for a ceiling speaker will be impossible to move once the drywall is up.



Figure 8. The rear speakers work equally well in the wall or ceiling. Everyone on site will have an opinion about where they look best, but check with the theater designer to find out where they'll sound best.



Figure 9. The front speakers in this theater project audio straight out through a sound-permeable viewing screen. In this photo, the screen has been retracted into the ceiling. The door and air intakes pass into the rack room behind the wall.

are usually made from this kind of fabric, so it's easy to hide the front speakers behind them (Figure 9). Subwoofers can be tucked into a corner, concealed behind fabric in a wall niche, or placed in the floor and covered with a metal grille.

We've occasionally used special flat panel speakers made by Sound Advance Systems (Santa Ana, Calif., 800/592-4644, www.soundadvance.com). The panel is installed flush to the drywall, skimmed with joint compound, and painted to match the wall. It's completely invisible and works fine as long as the skim coat is less than 1/8 inch thick.

Screens

Home theaters use rear-projection, plasma, or front-projection screens. Most family room theaters contain rear-projection TVs because they're an economical way to get a big picture. Screens are measured diagonally; rear-projection units are typically between 45 and 80 inches.

Plasma screens are thin and hang from the wall. They're very expensive on a per-inch basis and measure between 32 and 70 inches across. I tend to use plasma screens when there isn't room for anything else.

Front-projection systems provide the biggest screens, up to 100, 120, or 133 inches across. The projector is mounted in the ceiling or back wall and projects

the picture onto a blank screen at the front of the room (Figure 10).

Installation Issues

Rear-projection TVs are relatively economical, but you need to factor in the cost of what goes with them. For example, most people will want to house the unit in a cabinet. It might actually be cheaper to use a costlier plasma screen if it allows you to omit the cabinets and the 2-foot strip of space they occupy.

Plasma screens weigh 90 to 180 pounds, so the framing must be blocked accordingly. Also, be aware that plasma screens stand several inches off the wall. One of our clients objected to seeing this gap from the side and asked us to fit a trim piece around the perimeter. If we had known about the issue in advance, we'd have asked the contractor to frame a niche for the screen. That would have provided a clean flush-mount installation with minimal added cost.

Entry-level projectors and most mid-level projectors have noninterchangeable lenses. This means that they must be mounted a specific distance from the screen — 11 to 15 feet for a 100-inch screen and 15 to 20 feet for a 133-inch screen. This might determine the size of the room and whether the projector goes into the ceiling or wall. The projector should



Figure 10. Projectors are noisy, so they're typically placed in soundproof enclosures. This unit projects through a piece of glass and can be serviced through the access panel below. The box is mechanically vented through the soffit to prevent the projector from overheating.



Figure 11. The theater in this house is part of a larger home automation system. All the electronic components are housed at a remote location in a closet or rack room.

be mounted at the same elevation as the top of the screen unless it has a “keystone correction” feature, which allows you to adjust the image for distortion if the projector is mounted at an angle to the screen.

Room size and layout. There is an ideal relationship between the location of the seating and the size of the screen. However, the relationship is different for different types of screen. Consult with a theater designer before you start framing, because the configuration of the room will have an effect on the kind of screen the client can buy.

Component Storage

Home theaters are often part of an A/V system that’s linked to other rooms in the house. As a result, a large number of electronic components may need to be housed. We run all the A/V wiring to a single closet or rack room and put the components there (Figure 11).

The DVD player is the only component that has to be inside the theater. We put it behind cabinet doors so the viewer won’t be distracted by the panel lights. Closing the doors disables the remote, but for a few hundred dollars you can install an infrared repeater that relays the signals to the DVD player.

Video game consoles can be hidden in the same cabinet as the DVD player.

To avoid stringing wires across the room, we put A/V jacks in the wall or floor next to the couch. That way the kids can plug in their game controllers wherever they’re sitting.

Hvac Issues

Because projector fans make noise, they’re typically installed in sealed enclosures with glass windows in front. Heat is exhausted by connecting the enclosure to a duct with an inline fan. The supply can come from an adjacent room, and the exhaust can go to the rack room or some other nearby area. The rack room will get very warm, so it should be mechanically vented to the exterior or to a nearby room. All the trades need to know in advance where these ventilation ducts will be located.

Ideally, a dedicated theater room would be on a separate hvac system. If it’s not, the hvac ducts can act as an escape path for sound and create an amplified booming effect throughout the home.

Seating

Dedicated theaters often have individual theater-style seats. Viewers often find them more comfortable than a couch, but at \$800 to \$5,000 each, they’re a bit pricey for most people. We use platform seating when there will be more than one row across. Each level should be at least 7 inches, and preferably 14 inches, higher than the level below. The platform should also provide a 2-foot walk space in front of the seat.

Family Room Theaters

People without the space or budget for a dedicated theater can often afford to put a theater in the family room (Figure 12). Clients will get more for their money if they consult with a theater designer before finalizing the plans for this room. Decisions about layout and finish materials will have a big effect on the performance of the room.

The most important decision is where to put the screen. In many



Figure 12. A family room theater is a step up from a theater in a box because all the elements are built in. In this theater, the front speakers and screen are fully housed in a cabinet. The woofer is at bottom right and the rear speakers are built into the wall.

Family Room Theater Layout

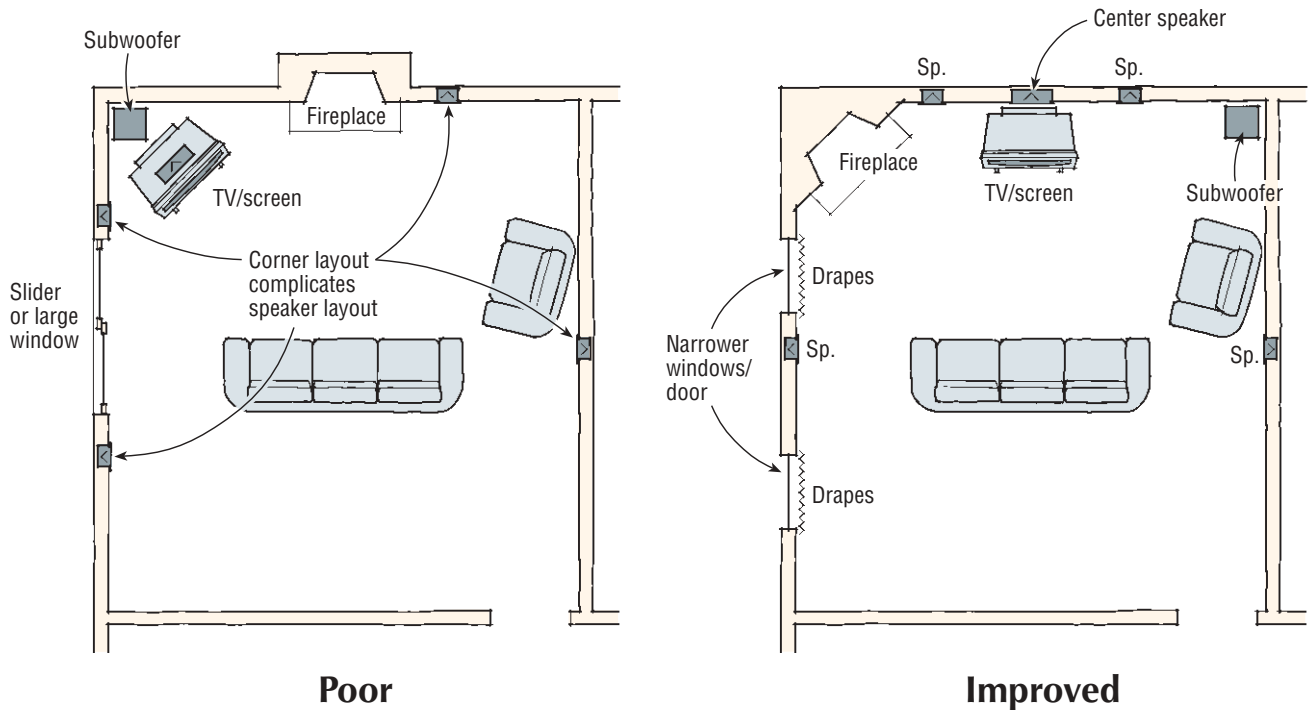


Figure 13. It's a poor idea to locate the screen in a corner because there's no logical place to put the speakers. Putting the fireplace in the corner and using smaller windows allow you to put the speakers where they belong.

family rooms, the TV is in the corner with a slider on one side and a fireplace on the other. In a theater, that's the last place you want to put the screen. The sound is better when you can put some space between the left and right front speakers, and that's not possible when the screen is in the corner (Figure 13).

Door and window placement has a big effect on family room theaters. Light may reflect off the screen if the unit is next to or across from a window. The viewer can close the drapes but may not want to during the day. A possible solution is to shift the location of the windows or use narrower units. The lack of windows is one reason a basement is a good location for a home theater. The built-in soundproofing provided by the foundation mass is another advantage.

Doors and windows also affect where you can put speakers. Sometimes the

only place to put the speakers is high in the wall, but headers may prevent you from doing that.

Fireplaces

Many family rooms have a fireplace in the middle of the wall. But you'd be better off putting the fireplace in the corner and the screen on the middle of the wall. After all, most people spend more time watching TV than watching fires. If the fireplace has to be in the middle, consider pulling the screen as close to it as possible and putting it on a pivot so you can see it from the middle of the room. Another possibility is to mount a plasma screen over the fireplace, but be sure it's within 50 inches of the floor to be at a comfortable viewing angle.

Recessed lighting can be used in theaters, but the fixtures should be placed so that light doesn't wash across the screen. Also, avoid putting cans

directly in front of the projector because this may wash out the image.

Cost

Home theaters aren't cheap. Our company prepackages a variety of systems that can run as high as \$175,000 if you include the millwork. One of our standard packages costs \$90,000, while another goes for \$25,000. We have also installed a number of systems for a Southern California developer who offers them as a \$10,000 upgrade to his tract homes.

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