



HOW TO PREWIRE YOUR SMART HOME

A guide to prewiring a low voltage system for audio/video, security, and smart home control.

by **MATT MONTGOMERY**

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How To Prewire Your Smart Home

by Matt Montgomery

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First edition 1.1, 2016

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Published by TYM™ LLC.
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Sandy, Utah 84070
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Clients include custom home builders and their clients, production home builders, as well as commercial developers in Utah, Idaho, and Texas. His completed projects have been featured in Electronic House, TechHome Builder, and CE Pro magazine, and Spaces Magazine.

Matt Montgomery

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PREFACE

I'm a product of the DIY (Do It Yourself) world. As far back as I can remember, my brothers and I have been buying 'How-To' books, or researching online to teach ourselves how to finish the next crazy project. We watched my brother Gomer (Greg) design his first professional recording and video editing studio by pouring over books at the library, and spending hours with his friend Google. When we began flipping homes, my brothers Brad, Scott and myself, frantically read every 1-2-3 Home Depot book we could get our hands on.

Two years ago, we spent hours on Youtube, and Google trying to figure out the best way to install our first fiber-optic star ceiling. What an adventure that turned out to be! And even today, after 6 years in the business, we constantly turn to online resources to teach ourselves how to execute the next big project.

Needless to say, I have a great appreciation for the DIY world, and those brave souls who routinely take on new projects and learn new skills. So when the opportunity presented itself to start helping our DIY friends design and install their own large scale Smart Home systems, it was a no brainer. We saw the need to develop a set of resources to help people like yourself design and install your own Smart Home. This is the first installment in what we hope will become a very extensive set of resources for our friends. And... we hope you like it.

All the best, and good luck with your prewire. We hope it's a fun adventure.

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SHOULD YOU PREWIRE YOUR OWN HOME?



If you are reading this, you've probably already decided you want to prewire your own home. Are you're still wondering if you 'CAN,' and maybe more importantly if you 'SHOULD?'

We think you can, especially with our help. Don't underestimate the prewire. It's no small task, but it's not rocket science either. We've laid out all the tips and tools you need to prewire your home successfully. You can always reach out to us with questions throughout your project.

The question you need to ask is whether or not you SHOULD prewire your own home. The time commitment usually surprises people. The average large scale prewire has 100-200 **drops**. We'd recommend you budget 25 minutes per drop, which would be somewhere in the range of 25-50 hours to prewire your home.

Don't let that discourage you. People call and email every week to tell us about their prewire projects. You just want to make sure you set aside a realistic amount of time to do it.

After you determine your time commitment, here's a few additional questions to consider for your prewire.

1. Are you physically able to put in 25-50 hours in a week's time to prewire your home? Can you go up and down the ladder, or climb through the attic if need be?
2. Do you have someone who can give you a second hand?
3. Will the builder give you extra time in the schedule to prewire? Builders typically allow 2-3 days for larger low voltage prewires. If you're prewiring

DROP, n.

1. A drop is each individual wire that you run and manage.

Our experienced Service Team budgets 15 minutes per drop when we estimate time for a prewire. If it's your first time, we suggest you budget 25 minutes per drop

nights and weekends, you probably need the builder to give you 5-7 days to prewire?

If you feel good about your answers to these questions, then you absolutely CAN prewire your own home, and we think you should. Finishing a prewire project is always a satisfying experience.

Be sure to send us photos of your prewire project. It might just end up on our [Intsagram](#) page.



"People's Choice Winner"
2015 Salt Lake Parade of Homes.
Custom builder: Tree Have Homes
A/V & Smart Home integration: TYM

2 PREWIRE VS WIRELESS

Lets tackle this question now, so you can be confident in what you want to prewire as you're designing your system.

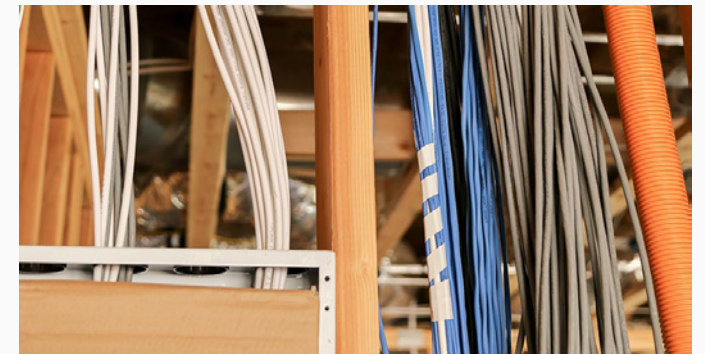
In general, if we cover it in this book, we think you should prewire. We have some great post on our site about [hardwired vs wireless](#) gear in the home, but here's the short and skinny of it.

I heard an interview with Steve Jobs where he was asked if he thought tablets would bring an end to laptops and desktop computers. I think Steve's response applies well to our discussion. Paraphrasing, he said that 'computers are like trucks, and tablets are like cars. You're always going to need your trucks to do the heavy lifting.' So he believes we'll always need both. The analogy applies to hardwired and wireless tech in the home as well.

You prewire the items that do the heavy lifting. 4K Video content is a lot of content to stream. It requires some heavy lifting. The '4k Streaming Services' are actually compressing the content – which means they're pulling detail and information out of the content – to squeeze it into a package size that's small enough to stream wirelessly in your home.

Wireless technology is improving all the time, but there will always be some heavy lifting to do inside the home that requires 'trucks.' For those applications, we're going to prewire. For everything else you can install all the wireless gear you like.

More from Matt on this topic:



IS WIRED BETTER THAN WIRELESS?

When wireless is great, it's great, but when it's bad, it's really bad.

[READ MORE](#)

3 FIRST STEPS



Here's a quick checklist to help make sure you have everything in order to start your prewire.

1. **Check with your builder** – If you're building your own home, or acting as the general on the job, then you can skip this step. If someone else is building your home, you want to check with them first. There are a couple things you need to find out.
 - a. Builder Approval - Some builders have agreements with suppliers where they receive deep discounts in exchange for guaranteed work. These kinds of arrangements can prevent builders from allowing you to do the work on your home. It's good to understand it's not because the builder is trying to be difficult, they just genuinely may not have the option.
 - b. Sign a release - Many builders will have you sign a document, releasing them from liability if you fall or get injured on the job site.
 - c. Schedule – will the builder give you the time you need in the schedule to get the work finished? You'll likely need 2-3 times the normal allotted time for the prewire.
 - d. Rules to play by – Find out any rules or regulations that are particular to your builder. For example, some builders will give you permission to prewire your low voltage, but will fine you if you touch any electrical. They may have requirements that you only work after hours so you aren't in the way of other trades. This is really important. We had a customer who got permission to prewire his own home, and then brought us in. He moved an electrical outlet in his Master Bedroom and the builder fined him \$450 for moving the outlet. It doesn't need to scare you away from doing the prewire. Just find out what the builder's rules are, and play by them.
 - e. City Permits and Regulations - it's worth checking with your city to see about any necessary permits or special requirements specific to your area. As an example, some cities now require backboxes for all speakers as part of the fire code.

2. Contact Local Service Providers – you should contact your Cable/Satellite Provider, and your Internet Service Provider to see what they recommend for wire. We'll cover the Demarcation, Satellite Prewire, Internet Satellite, etc., but we are only able to give best practices. Requirements vary by provider, and market-to-market. So you need to call your local providers, and see what they're requiring for their services.

3. Design your prewire – To design your prewire, I like to grab some colored sharpies, or pens. I use one color for my speakers, another color for my TV's, etc. Print out your floor plan, and start drawing in the locations of the different items and devices you plan to prewire. Especially if this is your first time, I would print off a few copies. You'll probably do it 2-3 times before you come up with a plan you are really excited about.

Don't be afraid to try things here, and be creative. Often when we prewire a home, the Client asks us to do something we've never done before. One of the last Parade Of Homes we prewired, the Client wanted speakers throughout all hallways in the home. He wanted to be sure that guest could hear the music at any time, in any place of the home. It was a huge hit at the Parade, so we incorporate it into our prewires all the time now.

The next section will cover a few basics about which wires you should use, and best practices. Each section will show our recommendation for the prewire, as well as a minimum needed, and then notes about how to run and manage the wire. But if you're still feeling a little uneasy about the design, check out our [Prewire Design Service](#), and we'll take care of the hard work for you.

4. Estimate your cable needs, and order your supplies – we'll get into specifics throughout the book, but the most important part obviously is

— TIP —

Here's a helpful tip. The more boxes of cable you have, the fewer runs you have to make, and the less time you have to spend. Think of the TV. If you have (2) Cat6 Shielded, (2) Cat5e, and (1) Coax to pull to the TV, but you only have one box of each wire, you'll have to make 2 separate runs to the TV.

The fear is that you'll have left over wire that you've paid for, but it's much better to factor in enough boxes of cable to pull things in one run as often as possible.

the wire. We budget 100' of cable per drop. If the home is over 7,000 square feet, we budget between 150-200' per run.

5. Coordinate with your electrician – Be sure to coordinate with your electrician. Throughout the book, we'll cover locations where you need outlets. One thing that helps is to send your Prewire Design Plans to your electrician. That helps the electrician see all the places he or she needs to place outlets in the home.

As you get closer to the prewire, it's a good idea to walk the home with your electrician and solidify locations of TV's, projectors, Components, etc., so you're both on the same page.

■ A quick review for your Prewire Design

Below is a quick review of wiring tips and best practices to help you design your prewire plans.

1. Cat5e vs. Cat6: I think we've reached a point with technology where it makes a measurable difference to use Cat6, and even shielded Cat6 in every home. That being said, I don't believe you need to use Cat6 for everything. The following items break down the wiring recommendations with respect to Category wire.

- a. **4K Video Content** – The Current recommendation for 4K Video Distribution is (2) shielded Cat6 per TV. Full 4k content will come to us in 10 bit color and 60 frames per second. Manufacturers are suggesting that a single Cat5e or Cat6 wire won't have the bandwidth to send the full res 4K content, with the 10 Bit Color and 60 frames per second. You'll get 4K content, but essentially a watered down version.

To be clear, the recommended (2) Shielded Cat6 wires are both being used for the TV, so there's no spare. If you're concerned about a spare wire, you should run a 3rd Shielded Cat6.

- b. **Control** – 'Control' is a word that simply means you're sending commands to a device. Like telling a TV to turn on, or change channels. There's a variety of ways to send control to a TV, but to keep it simple, just trust us and pull a Cat5e for Control. That leaves your options open for any of the Control methods you might use.
- c. **Internet for TV** – You want to hardwire your TV's into the Internet, even the Smart TV's. Your Smart TV's have wireless, but for things



like 4K content, services like Netflix require a hardwired connection for download. The hardwired Internet connection also enables a form of Control.

- d. **TV** – If you aren't planning on Video Distribution, but still want the option for Satellite, and/or Cable, you need to pull a RG6/Coaxial Cable to each TV. Even if you aren't planning on Video Distribution, I would still recommend (2) Cat5e to keep your options open.

So if you're following along, and doing the math, the best possible prewire for your TV would be (2) shielded Cat6, (2) Cat5e, and (1) RG6, and the possible addition of a spare wire.

2. Fiber – is becoming more popular, and we get asked regularly to prewire homes with fiber. The expense in Fiber is really in the termination. If your goal is simply to future proof, than my recommendation is that you pull the fiber to the intended location, but then leave it in the wall, and save postpone the termination. You can always terminate it later when you're ready to actually use it.

3. Surround Sound – You probably are thinking about a 'Home Theater' surround sound for one room in your house. That's great, but every TV in your home will benefit from external speakers. We call these Secondary Surround Systems. It could be a 3 Channel Soundbar, a full 5.1 Surround Sound, or just two speakers in stereo. It's best to keep whole house audio speakers separate from the TV and surround speakers. So you want to factor that into your plans.

4 LETS GET STARTED – LOCATING & PREPPING THE MEDIA RACK

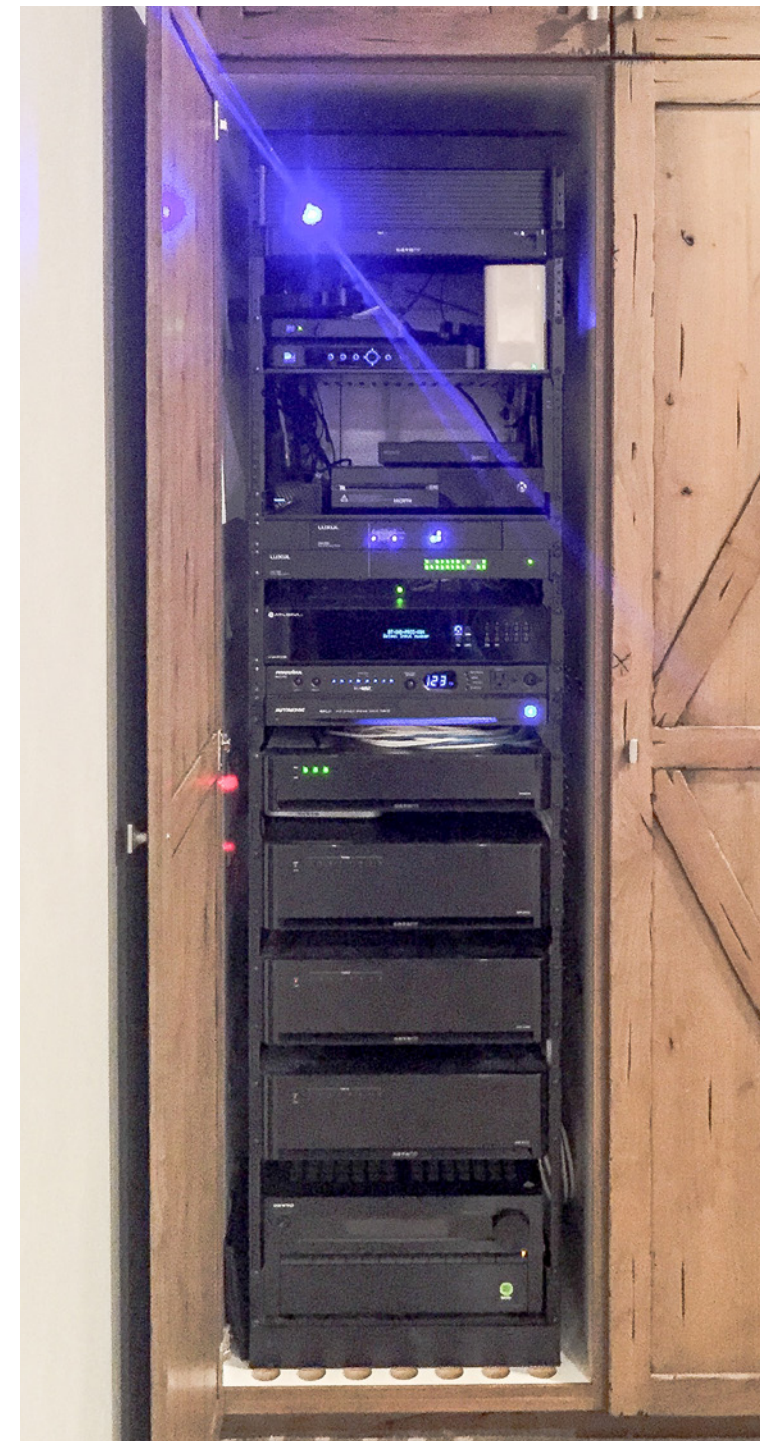
You've coordinated with the builder, talked to your local service providers, designed your prewire, and you've ordered all your cable and supplies. It's time to start.

For your first step, you want to determine the location of the Media Rack. Often times during pre-construction, the plans will indicate an available space for the Media Rack. But when the time comes to prewire, the space may no longer be available.

So first thing, we like to determine the location of the media rack. There are a few things you want to consider:

- 1. Can you easily pull wires to the media rack?** If the room is surrounded by ductwork, it may be very difficult to pull wire to the media rack.
- 2. Can you manage the temperature of the space?** If not, can you easily vent the rack to pull heat out?
- 3. Have the electricians given you the proper outlets and power?** Our minimum recommendation is a dedicated 20AMP outlet for the media rack, and one regular outlet for the inside of the Low Voltage Panel.
- 4. Where is the Low Voltage Panel?** You'll need to pull a few wires from the Low Voltage Panel to the Media Rack. It's nice if the two locations are close to each other, but it's not necessary.

NOTE: If you're installing Racks into MEDIA CABINETS, or IN-WALL, you need to do your homework, and make sure the opening is big



enough for your rack, and properly vented for heat control.

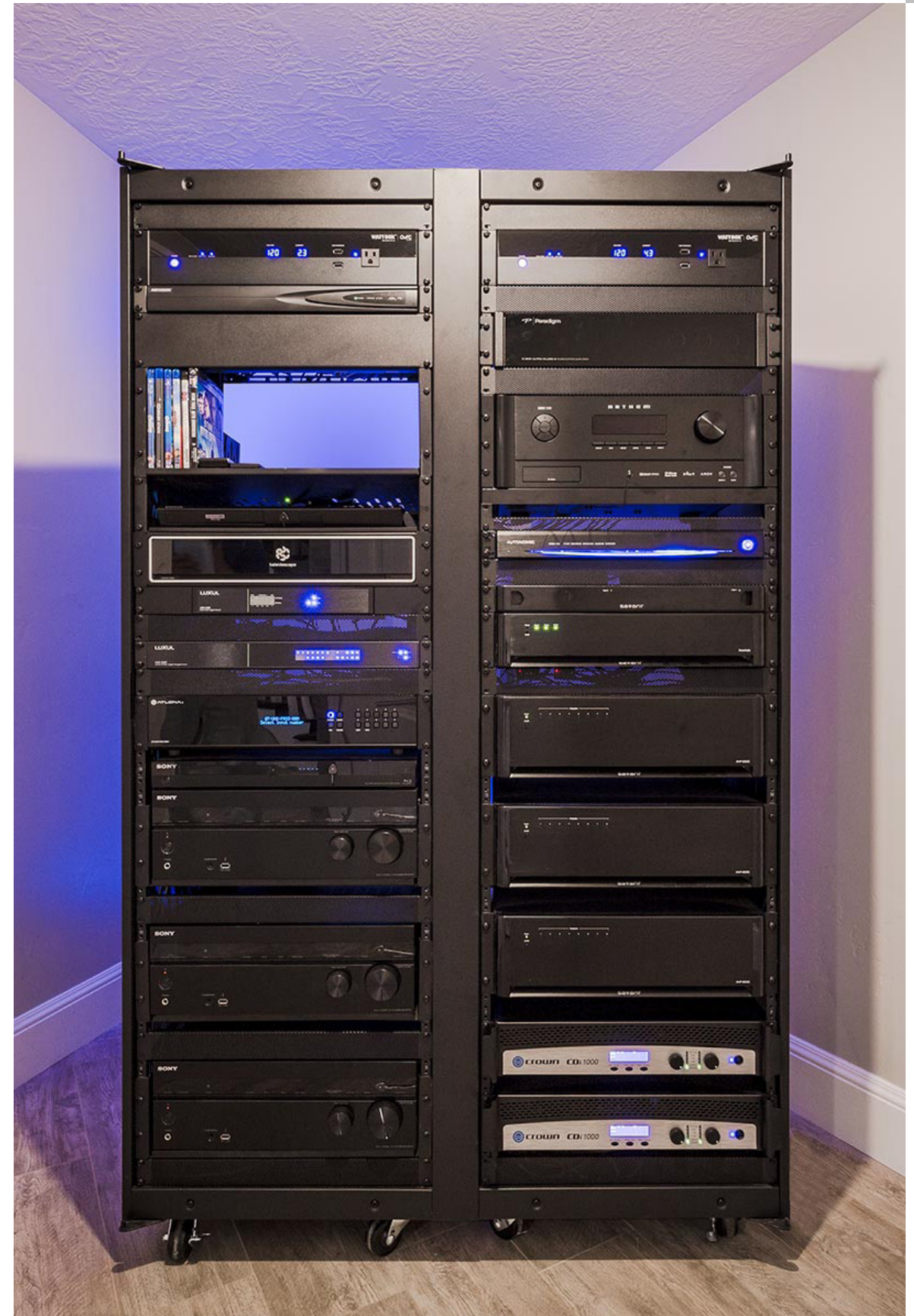
Items like cable management behind the rack, space for the cabinet door to close, and a fan for venting all effect the overall space needed for your Media Rack.

Here are 3 common places for media racks:

Media Closet – This is my preference. It's typically a dedicated room or closet. It's close to the Low Voltage Panel, and it's usually an easy room to keep properly vented and cooled. It's also easy to maneuver the media rack to service components as needed.

Built-Ins – You can install a rack into a Media Cabinet. They make special racks that rest on tracks. The tracks allow the rack to slide out of the cabinet, and swivel for easy service. You can also frame out an opening in the wall, and install the cabinet into the wall. These can also be slide outs, but more typically there's access to the rack for service on the other side of the wall.

Free Standing – I don't recommend this approach. It's difficult to keep it attractive esthetically, and it's prone to issues with curious little fingers, but it can be the only good option in homes limited on space.



Media closet with exhaust fan for temperature control.



Multiple holes make for easy organization during prewire.



Low voltage brackets (mud rings) can help with cable management.

NOTE: Our recommendation is that you prewire as though you're planning to install a Media Rack, even if you never do. Your prewire and your trim will benefit from this approach, and it gives you greater flexibility for expansion.

If you want to prewire everything to a media cabinet, or an entertainment closet, that will work too. Follow the notes and instructions in the book the same way, but make sure you account for space, proper ventilation, and connections to your Low Voltage Panel.

Once you've made your decision on the spot for the media rack, it's time to prep the location. One of the biggest time savers on a prewire, is managing the cable as you go.

A lot of people get so excited to go fast they cut the wire, and leave the management for later. Overtime, this creates a large rat's nest, and can take hours to untangle and label properly.

It only takes a few minutes to prep the Media Rack upfront, but it will save you hours of time in the long run.

Here are the steps for prepping your media rack:

- 1. Verify you have an outlet** – Make sure the electricians gave you a dedicated 20AMP outlet. If they didn't, make sure they're going to get you one before you prep the space.
- 2. Drill 2" holes** – Most the time, wires for the media rack, are going to come into the room through a top

plate in the wall (the piece of 2x4 wood that runs horizontal at the top of the wall). Whenever possible, we drill multiple 2" holes. If it's not possible to drill 2" holes, drill the next best size that works. If you're pulling 100-200 wires, you're going to need multiple holes.

These holes are your first opportunity to start managing wires as they come into the media rack. I recommend labeling each 2" hole for the different types of wire you plan to pull through. You can have multiple cable types in each hole, but the more deliberate you are about this, the easier you'll make it on yourself.

EXAMPLE: Pull all your Cat6 and Cat5e for Video Distribution through one 2" Hole, and all your whole house audio through another 2" hole.

3. Place Low Voltage Brackets – You need a place near the floor for the wires to come out of the wall. We typically use a double gang low voltage bracket, but the number isn't important. Just make sure you have enough space from your bracket to comfortably pull all your wires through. For placing the brackets, match the height of electrical outlets in the home. It's typically between 14-16" from the floor to the top of the bracket.

NOTE: Real quick I want to make sure it's clear what's happening here. When the home is finished, your wires are going to be concealed behind the wall, and out of site. When you



Low voltage brackets (mud rings) for cable management.



Low voltage brackets (mud rings) for the main snakes to the media rack.

bring the wires through the 2" holes in the top plate of the wall, you're transitioning the wires from the ceiling into the wall. The low voltage brackets, allow you to then bring the wires back out of the wall so that you can connect them to the media rack.

4. Measuring wire length – before you pull your first wire, you want to establish some markers near the media rack to help you measure your wires to the proper length.

a. We recommend 10-12' of wire from the floor. This often surprises people, but here's why. The media rack can be 6' tall, and you'll need to be able to slide it out 4-5' for servicing. So from the place where the wire first hits the floor, you need 4' of slack for the rack to slide out, and then 6' of wire to go back up to the top of the rack.

b. I want to make sure my wires are all measured the same. So I run my first wire, feed it through the 2" hole, on through the low voltage bracket, and then I measure it to length and cut it.

c. Lastly, I stretch out my measured wire, and place a mark some where in the area so I know where to cut future wires.

d. As long as I run each additional wire through the low voltage bracket, and pull it to my cut mark, my wires should all be fairly close to the same length.



I like pulling all my cable through the Low Voltage Bracket before I measure. It gives me something to make sure all cables are the same length.



2. Labeling Cables – In addition to the cut mark, I set a labeling mark somewhere in the room. Similar to measuring wires, this allows me to label all my wires in roughly the same location. I mark every wire in two locations.

- a. 12” back from the end of the wire
- b. Just as the wire comes out of the low voltage bracket

So now that I've prepped my media rack, I can pull all my cables to length, and label them quickly as I go along.



Label each wire a few inches above where you plan to cut.



Only after labeling, cut the bundle to length.



Always keep cable bundles tidy.

5 INSTALLING THE LOW VOLTAGE PANEL

The low voltage panel looks a little bit like an electrical panel. It's usually white, and 20-40" tall. Its primary purpose is to bring services like Satellite, Cable and Internet from the outside of the home to the inside. But we'll use the Low Voltage Panel for a few other things as well.

- 1. Locating the low voltage panel** – There's really no right or wrong place to put the Low voltage panel. It's often found in the mechanical closet, or near the electrical service panel. We've placed them directly behind the media rack. Just make sure you have a place for it.
- 2. Installing the low voltage panel** – If you're placing the panel in the same room as the electrical panel, set the top of the low voltage panel so it matches the height of the electrical panel. The low voltage panel is designed to fit snug between two studs.
- 3. Verify you have an outlet** – You need to have one outlet inside the panel. The panels have a knockout plate, that allows you to bring an electrical wire through the bottom of the panel, and for the electricians to place an electrical box in the panel. Make sure the electricians have pulled a wire into location for you. This can just be a regular outlet. If possible it's nice to have a second outlet immediately outside the panel.
- 4. Organizing Wire** – I like to organize the cable a bit as it comes into the low voltage panel. Usually you'll have 4 holes across the top of the panel. I'll pull all Coaxial cable, and Network cable through the left side. Security cables, and low voltage accessory items like iPad Mounts, I pull through the right side.
- 5. Measuring Wire** – I pull every wire through the top of the panel, bring it down to the base of the panel and then over to the far side. The wire makes the shape of an L. That's how I measure the length.



Place the low voltage panel(s) at equal height with the electrical panel(s).



Securely affix the panel



6. Labeling the Wire – Just like the wire for the media rack, it's nice to keep the labels in a similar spot. I usually mark the wires about 6" back from the end of the wire.

Congratulations you're ready for the fun stuff!



Do not place the low voltage panel all the way back. The front should be flush with future drywall.



Low Voltage Can: Left side is for TV, Right side is for Coax

6 GETTING STARTED PULLING WIRE

It's time to pull your wire. The best order to pull is a matter of opinion, but here are a few tips to get you started off right.

- 1. Find Main Trunks** – Most homes have several main paths, or trunks that your wire will pull through. The natural instinct is to just start pulling your first wire and create holes as you go, but this will cost you more time. Taking 5-10 minutes at the beginning to think through your wire runs, and determine a few common paths will save you tons of time.
- 2. Pull Jumpers** - You need to connect the media rack and the low voltage panel with 'jumpers.' This allows you to bring Internet, satellite and/or cable from the low voltage panel to the media rack. We usually pull (4) RG6, and (4) Cat6 from the low voltage panel to the media rack. If it's not too much work, we'll even pull a conduit between the two to be safe.
- 3. Pull Conduit** – If you have conduit for a projector, a TV, or maybe to the attic, pull it first. Long runs of conduit require a lot of drilling, tugging and pulling. So it's easier to do before you've run a lot of wire everywhere.
- 4. Pull Service Lines** – Your service lines all run to the exterior of the home. This is your Demarc (internet & cable), Satellite TV, Satellite Internet, and things like your landscape speakers. Usually these are the longest and most difficult runs of the home. So it's nice to get them out of the way first.
- 5. Pull by room** – I've found the prewire is fastest when I pull my wires by room, rather than by type of wire, or system. Before I pull any wire to a room, I walk through everything that needs to be run to that room, and then make a plan for the fewest number of runs to that room. This is where it helps to have multiple boxes of Cat6, or speaker wire. It allows you to really cut down on the runs to each room.

— TIP —

The remainder of this ebook is organized by system. We give notes on running wire for your TV's, your Audio, Surveillance, etc. We've found this is the easiest way to teach the topic. However when you actually run your wire, it's best to run it by room. So you'll have a combination of TV's, Speakers, iPad mounts etc., that you're pulling all at the same time.

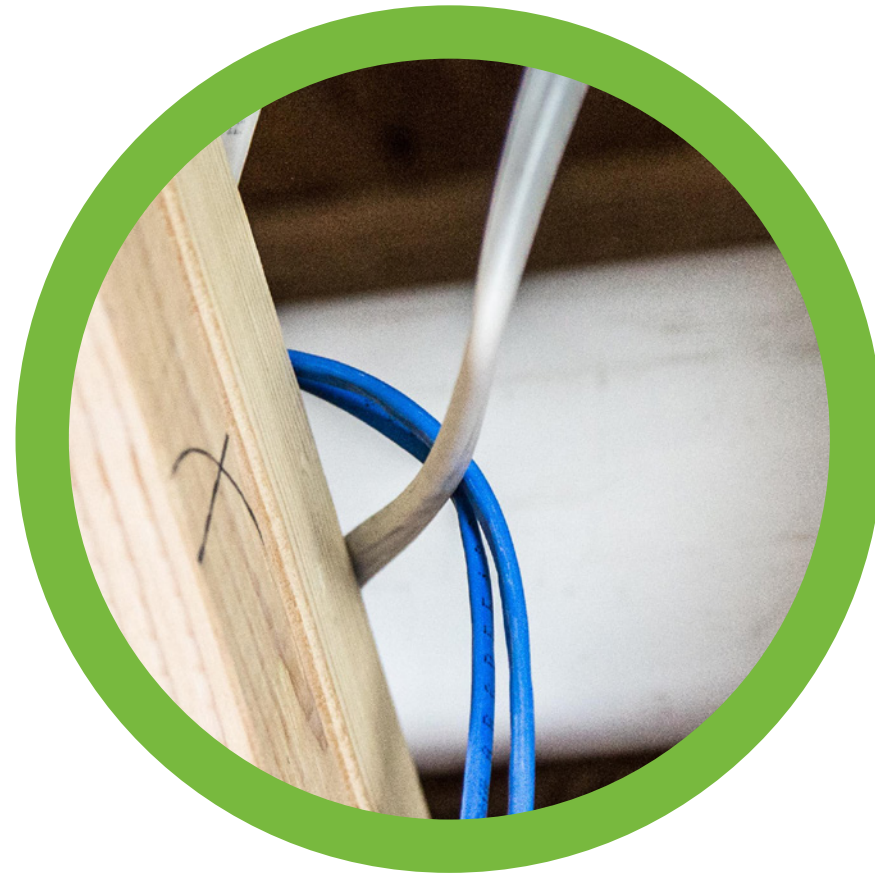


Place your boxes in a room to begin a run.

INCORRECT



CORRECT



Keep it clean. As often as possible keep your wires together. If you pull one wire over an electrical wire, pull all wires over the same electrical wire. If you go under a pipe, pull all wires under the pipe. It's a cleaner prewire, but it avoids the dreaded 'weave.' The weave creates friction and leads to cable damage as more wires are pulled. If the wires are run together, it's easier to manage the slack, and to zip-tie the wires all together when the job is finished.



Start the run.



Keep the run straight and organized.



Gently pull the cable to the mechanical room..



Drill a clean hole for runs between levels.

TVS AND VIDEO DISTRIBUTION

Recommended: (2) Shielded Cat6, (2) Cat6, (1) RG6/COAXIAL CABLE

Minimum: (1) Cat5e (1) RG6/COAXIAL CABLE

About the Recommended:

The recommendation for 4K Video Distribution from manufacturers is to use (2) shielded Cat6 cables.

For the last several years, Video Distribution has been utilizing a technology called 'HDBT.' It allows you to send your video content over (1) Cat5e cable. However, to enjoy the full 4K experience, it's recommended that you use (2) shielded Cat6 cables. You can still use a single Cat5e, and it can move 4K content using HDBT, but it will be a watered down version of 4k.

These (2) shielded Cat6 cables are both used for the 4K video distribution, so if you're someone who likes to run a spare cable in case of damage, you'll need to pull a 3rd Cat6

The additional (2) Cat6 cables are for Internet, and Control. You can use Cat5e for either or both of these cables.

Internet – It's best if your TV's have a hardwired connection to the Internet; even your Smart TV's. Services like Netflix require a hardwired connection to download 4K content. The hardwired Internet connection can also double for your Control wire with TV's that support IP Control.

Control – Smart Home systems send commands over a Cat6/Cat5e wire

More from Matt on this topic:



HOW TO PREWIRE VIDEO DISTRIBUTION

Often when we fire up a system for the first time, it's the Video Distribution that clients are most excited about.

[READ MORE](#)

to your TV. This is how you're able to turn the TV on and off, or change the channel from your Smart Home app. Some TV's support 'IP Control,' which means that you send the TV commands over the home network. Unless you already own your TV, and know for certain it supports IP Control, you're best to run a wire specifically for control.

You may be asking why you need the RG6/COAXIAL cable if you're planning to use Video Distribution.

1. I just like having the back up.
2. You may decide for budget reasons to postpone Video Distribution. In this case you would need the RG6 to watch your Satellite or Cable.
3. It's common for Clients to max out their Video Distribution. If you have RG6 behind every TV, you can always add a small Satellite or Cable box behind the TV.
4. The person who buys your home may not have Video Distribution. True story. We worked with a builder, whose buyer was FURIOUS that there weren't more RG6 cables all over the house for his Satellite receivers. The builder had to pay for us and the drywall company to come pull more Coax all over the house before close. That's unusual, but it happens.





Low Voltage Can: Left side is for TV, Right side is for Coax



Keep TV's Bundled together. I tape the (2)Cat6 for Video Distribution together, and the additional (2)Cat6 for Control and Network together.

About the Minimum:

The minimum recommendation will work. We've done it in a handful of homes, where Clients wanted to scale back the prewire. The Video Distribution worked, and we were able to control the TV's. With respect to 4K, remember you're getting a watered down 4K experience with this approach.

The minimum approach leaves you vulnerable to damaged wires, and technology changes. We've had several homes where one of the two Cat5e or Cat6 cables was damaged. Because we had a second cable, we were able to leave the TV on the Video Distribution system.

Cable Management:

Low Voltage Panel – RG6 goes to the Low Voltage Panel, and comes down the left side of the panel. Everything else goes to the media rack.

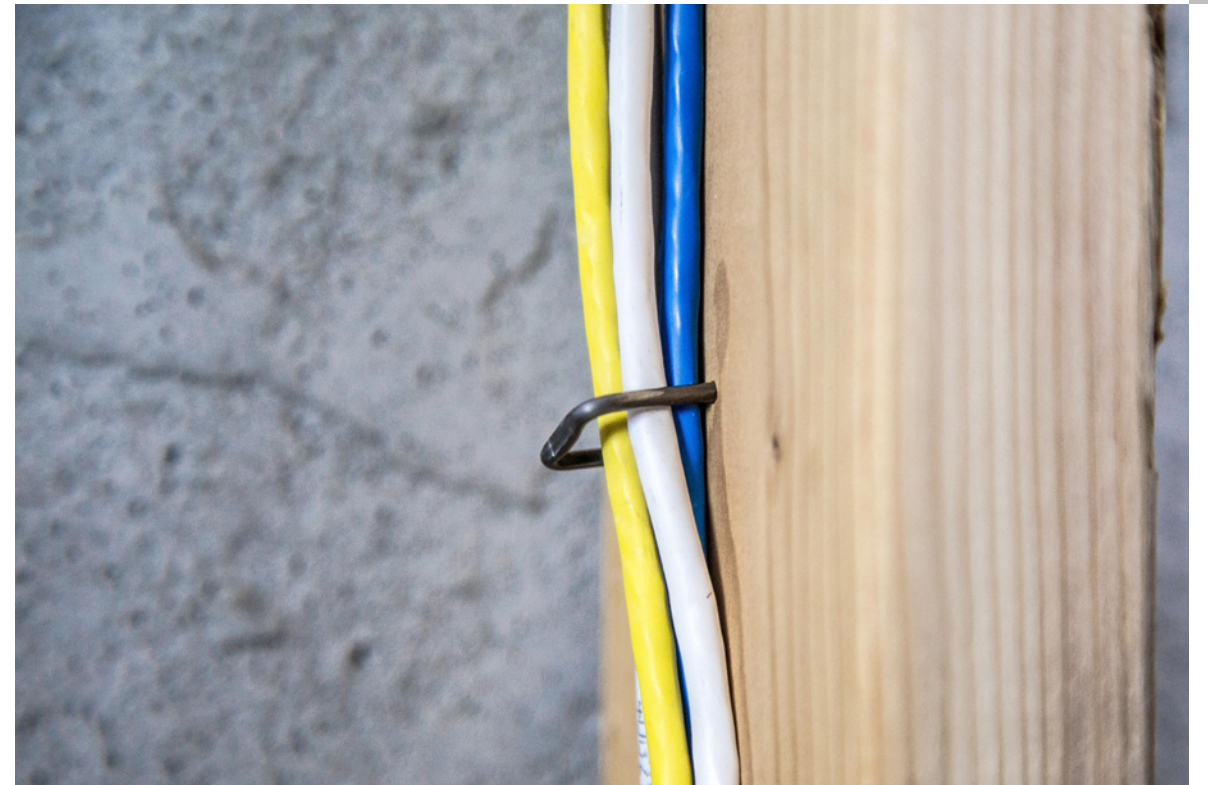
Measuring Length – Pull the RG6 down to the left hand corner of the low voltage panel, and then pull slack over to the right corner. The Coax will make the shape of the letter L. This helps you measure the length of the cable.

Labeling – Label the RG6 about 6" back from the end of the cable. If you're using Black Coax, put a piece of white electrical tape around the RG6 and use it to label the cable.

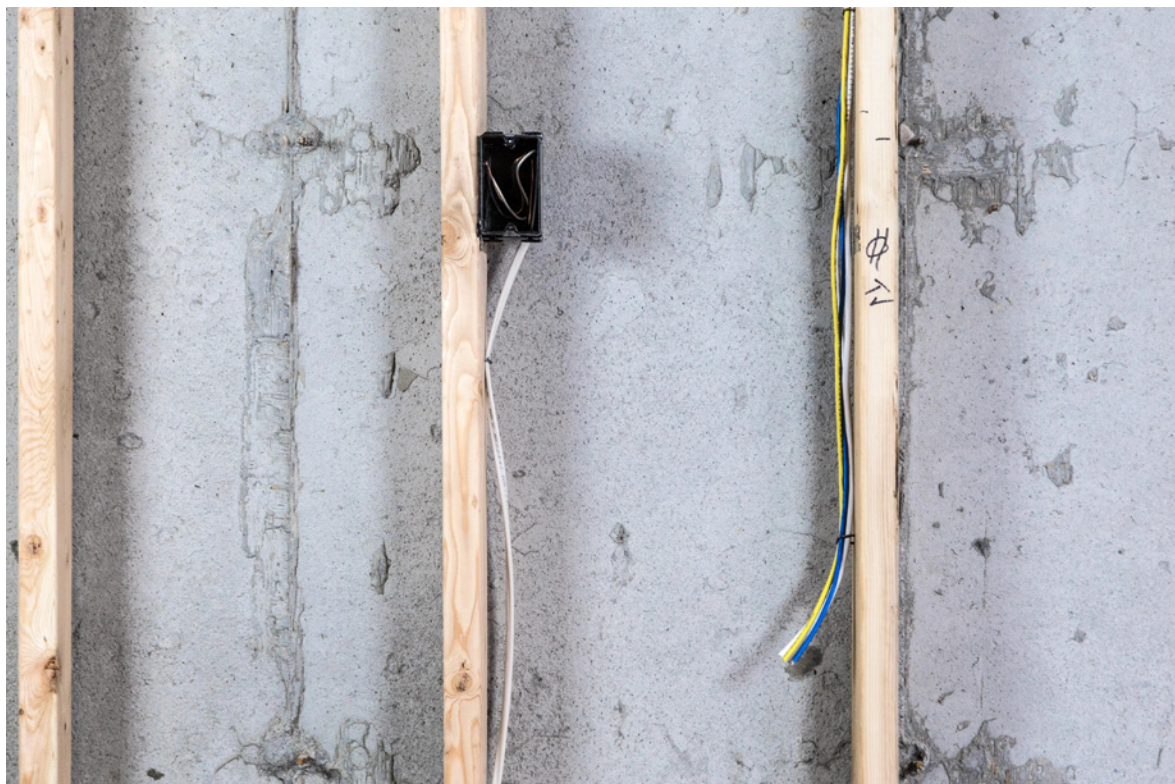
Media Rack – All of your Cat6 and/or Cat5e cables go to the



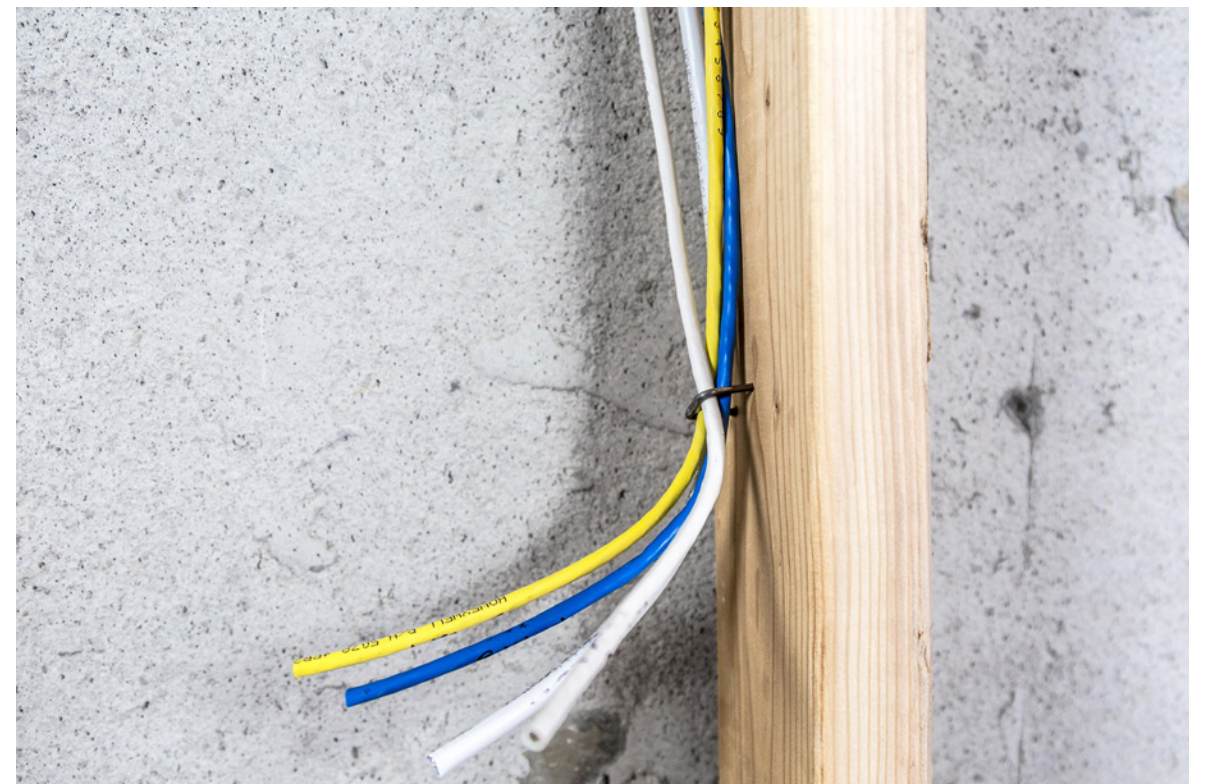
Untrimmed cables running along a stud.



Gently staple the cable bundle along the stud.



Trim the cable/wire back about 6" after the last staple.



The last staple holds the cable bundle in place for insulation and drywall.



Label the trimmed end of every cable/wire.



Labeled cables/wires.

media rack. Remember the RG6 gets separated out, and pulled to the Low Voltage Panel.

Measuring Length – Be sure to bring the Cat6 and Cat5e cables through the 2” holes you predrilled, and then on through the low voltage bracket. Pull the cables to the measuring marks you made, and cut to length.

Labeling – Use your labeling marks to label the cables. If you used different colored cables, you can just label them by the room name like ‘Kitchen TV.’ If you have same colored cable, you need to distinguish which cable is which. So label them Kitchen TV 1, Kitchen TV 2, and so on. Be sure the TV side of the cables is labeled the same way.

Cable Management – After I measure and label the cables, I bundle them together into a ‘Snake’ and tape them. Bundling or snaking the cables together by TV makes it much easier when it’s time to pull the cables into the rack.

TV – If all your cables are the same color, remember to label them so they match the cables in the Media Rack.

See our General Wire Management notes at the end

Securing the Cable – Follow the notes in the General Wire Management tips section to secure your wire as it comes into the TV location. I find it’s easier to staple the wire, before I have the low



Staple the cable bundle several inches above and below the low voltage bracket.



Finished TV drop ready for insulation and drywall.

voltage bracket in place.

Low Voltage Bracket – Place your low voltage bracket. You should only need a single gang bracket, but a 2-gang bracket will work if you prefer, or if you're bringing extra items to the location like conduit or fiber.

Staples - We staple the wire, to protect it from sheetrock damage. The loose cables, will swing around, and get caught between the sheetrock and wood studs. We place staples every couple of feet as needed. We place one staple just to the top of the mudring, and one staple about 8-10" under the box. The last staple is loose, so it's easy to pull the wire out at trimout.

TIP: Before you start pulling your wire, label the box of wire and the wire the same. I grab my 4 boxes of wire, and label the first wire Kitchen TV 1. Then I label its box Kitchen TV 1. That way when I finish the run, I'm sure the end of the wire gets the same label as the front of the wire.

NOTE: You might be wondering how Cat6 and Cat5e send Video to your TV? With Video Distribution, we use a small piece of hardware called a video balun. There's a video balun for each end of the Cat6 or Cat5e. These baluns convert the Cat6 or Cat5e into an HDMI, and you're able to send video content over the wire just like you would with any other HDMI.

8 HOME THEATER: PROJECTOR

Recommended: (1) 1.5-2" Flex Conduit, and/or (2) Shielded Cat6

Minimum: (1) HDMI, (2) Cat5e

About the recommended:

We've found the very best thing for your projector, is to pull a 1.5-2" flexible conduit from your media rack to your projector. This gives you the ability to pull HDMI cables, Cat6 cables, or anything else that you may need to pull to the projector in the future. If a HDMI goes bad, or if you need to upgrade the cable, it's very easy to pull a new cable to the projector. Right now as we transition to 4K Content with HDR, many HDMI cables need to be upgraded for Projectors. So it's nice having conduit in place.

You want to pull a large conduit, a minimum 1.5" conduit. It's difficult to pull HDMI through a smaller conduit, particularly if there's lots of bends and turns in the run, and you need to leave room for additional wires to control the projector as well.

We've been in theaters where it just wasn't possible to pull conduit to the projector. In these instances we pull a minimum (2) shielded Cat6 wires. You could certainly pull more, but we would suggest a minimum of (2).

About the minimum:

As mentioned above, sometimes it's not feasible to pull conduit to the projector. You can pull an HDMI, but I would recommend (2) Cat5e as a backup. If your HDMI ever goes bad, you can use one of the Cat5e as a new HDMI, and the second Cat5e you can use for controlling the projector.



Cable Management:

Projector: You'll pull the conduit and cables to the area just above the projector, or in the case of wall mounted projectors, the area just behind the projector. Use a single gang Low Voltage Bracket to place your conduit and/or wire.

Projector Outlet – Make sure the electricians provides an outlet. It's not required, but it's nice if it's a dedicated outlet for the projector.

Projector Distance – If you already know the projector your buying, consult the installation notes to find the optimum distance from the screen to your projector location. If you don't know which projector your getting, there's a few tips to help you.

1. Multiply the width of the screen you want, by 1.5. That will give you a rough idea of the location to place your projector. Remember you're measuring to the front of the lens, not the back of the projector.
2. Place the projector above or behind the back row. It isn't always possible, but it's nice for the projector to be out of view when you're watching the movie. The easiest way to accomplish this is to place the projector above, or behind the last row of seats.
3. If all else fails, and you aren't sure screen width, or seating, place the projector 16-18' back from the screen wall.

Projector Blocking – Place blocking in the ceiling for the projector to mount to. This doesn't have to be extensive, just find a piece of scrap wood, and secure it between the beams in the ceiling so there's something for the projector to mount to.

Projector Cable Management – Place a single gang low voltage bracket at the projector location. If you pull conduit, try and secure it to prevent other trades from pulling it out. If you're pulling HDMI, wrap the end of the HDMI with a bag or clear wrap to keep the end clean from paint and drywall mud.

Media Rack:

Conduit – if you run Conduit, bring the conduit down to the low voltage ring for the media rack. You can place it just above the media rack's low voltage bracket, and place an additional low voltage bracket for the conduit.

Cat6 and Cat5e Cables – If you run Cat6 and/or Cat5e cables to the Projector, pull them into the rack the same way you would for the TV. Bundle the cables together, and label them as the projector.



7.2.4 Dolby Atmos® audio system with in-wall front LCRs, sides, and surround speakers, in-wall subwoofers, and in-ceiling Atmos speakers. Acoustically transparent screen, and Sony 4K projection. Custom fiber optic star ceiling and cosmos mural.

GOLD WINNER
BEST HOME THEATER
HOME OF THE YEAR AWARDS
ELECTRONIC HOUSE
2016

\$25,000 - \$75,000



5.1.2 Dolby Atmos® audio system with in-wall front LCRs, sides, and surround speakers, a floorstanding subwoofer, and 2 in-ceiling Atmos speakers. Acoustically transparent screen, and Epson HD projection.

9 HOME THEATER: SURROUND SOUND

Recommended: (1) 14/2 for each speaker

Minimum: (1) 16/2 for each speaker

About the recommended:

For any of the following configurations, 5.1 (5.1.2, 5.1.4 for Dolby Atmos®), and 7.1 (7.1.2, 7.1.4 for Dolby Atmos®), we recommend pulling (1) 14/2 wire for each speaker. Some people pull a 12/2, but for most people and applications 14/2 is sufficient.

If you're prewiring a Dolby Atmos® surround system, you're going to use the same kind of speaker wire for the Atmos speakers.

About the minimum: The minimum gauge wire you can use is (1) 16/2 for each speaker

Cable Management:

Speakers: There's a variety of ways to prewire your surround sound. We'll cover some of the big ones briefly below.

Back Boxes: Backboxes are not required, but they're popular especially with higher-end speakers. Back boxes enhance the sound of the speakers, and are usually specific to the speaker brand. So it's something you want to do at prewire.

Speaker Brackets: Also called speaker rings. These are cutout rings that help the drywall contractor cut out the speakers for you. It also helps you line out the speakers and make sure their level, or lined up properly with lights or other fixtures in the room. Like back boxes, these are usually brand specific, and need to be

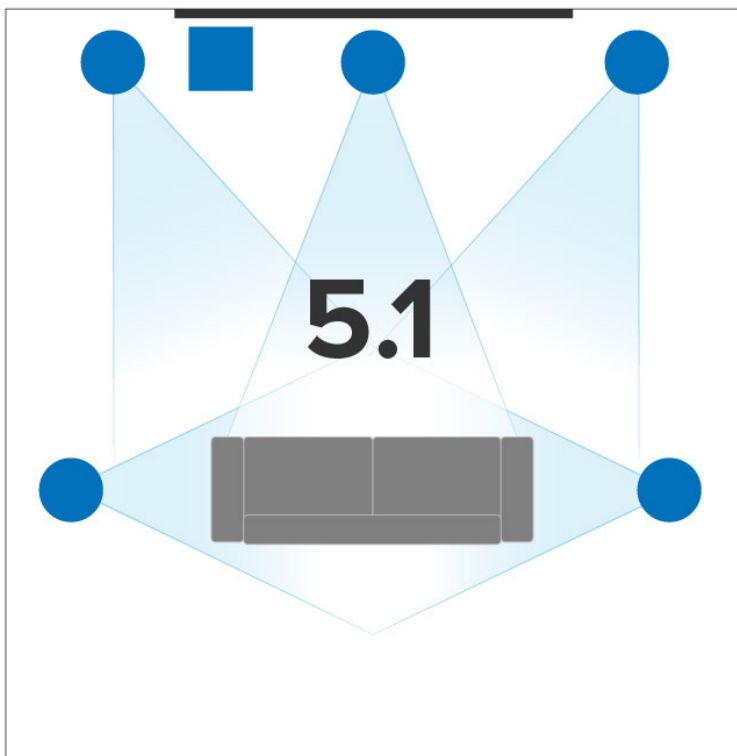
More from Matt on this topic:



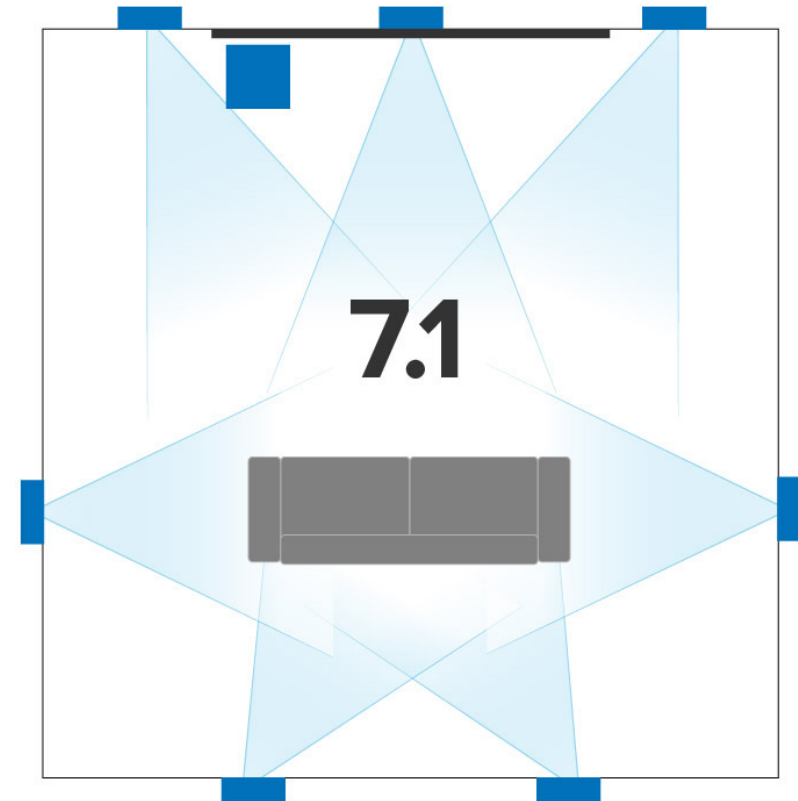
HOW TO PREWIRE SURROUND SOUND

Surround Sound isn't just for your 'Home Theater.' You can prewire for Surround Sound in your bedroom, the family room, or even the patio!

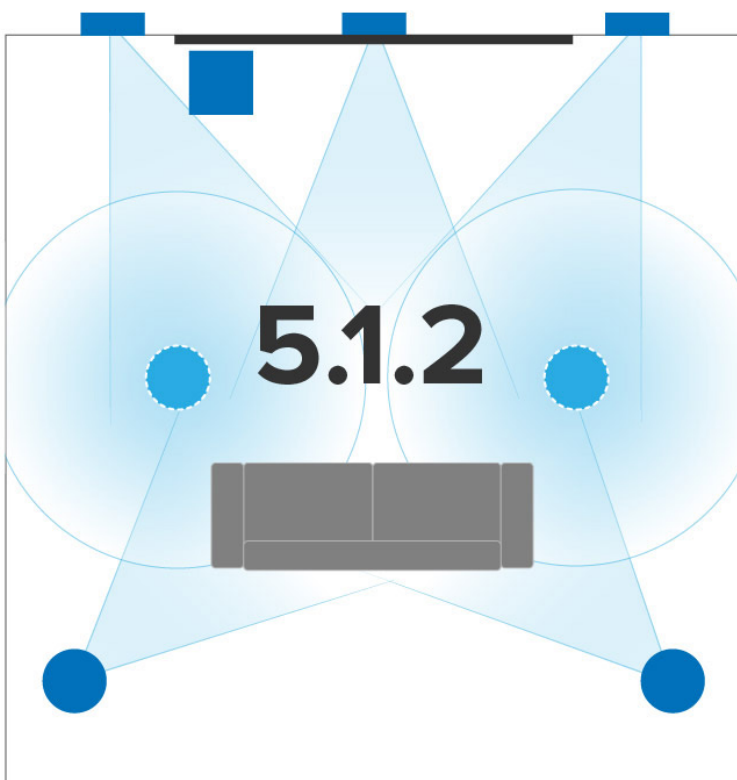
[READ MORE](#)



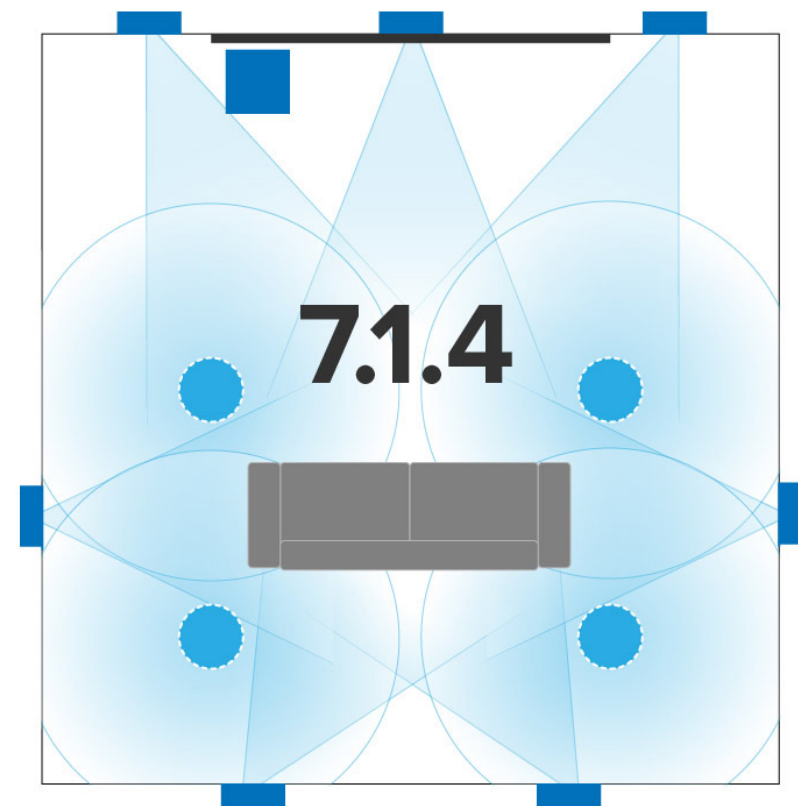
5.1 Surround Sound with In-Ceiling speakers.



7.1 Surround Sound with In-Wall speakers.



5.1.2 Dolby Atmos with In-Wall and In-Ceiling speakers.



7.1.4 Dolby Atmos with In-Wall and In-Ceiling speakers.

[CLICK HERE TO VIEW MORE SURROUND SOUND CONFIGURATIONS](#)

placed at prewire.

Hanger Strap – When we don't have back boxes, or speaker brackets, we use Hanger Strap. It's a vinyl strap that you get at Home Depot or Lowes in the plumbing section. We cut a piece that is long enough to span the two studs where the speaker will go. Fasten the ends of the hanger strap to the studs, and then poke the speaker wire through the strap as a reminder of where the speaker is suppose to go. The drywall contractor will know the wire is suppose to stick through the sheetrock. This works for both in-wall, and in-ceiling speakers.

Low Voltage Brackets – If you're using floor-standing speakers, or book shelf speakers, then you run the wire to a single gang low voltage bracket.

Note: Some people will use a nail in electrical box, and then try and pull it out when they cut in the speaker. Your speaker clamps to the edge of the sheetrock to secure itself. When you use the electrical boxes, you have to cut the opening for the speaker right up to the edge of the stud. It doesn't leave you much sheetrock for the speaker to clamp too. So we prefer using hanger strap.

Media Rack – Run the surround sound speaker wires through the 2" holes you predrilled, and through the low voltage bracket at the media rack. Use your marks, to measure them to length and label them.

Bundling Speaker Wires – If you have multiple surround



Gently staple the wire. DO NOT crimp the wires.



Create a zig-zag pattern

sound systems in the home, keep your surround sound wires separate. Just like TV's, bundle the wires for each surround sound together, including the wires for the subwoofer. When it's time to wire up the rack, it's very easy to bring each set of speaker wires cleanly into the corresponding surround receiver.



Keep all surround sound wires together.



Keep the surround sound bundles together, like these TV/Data runs shown bundled together.

10 HOME THEATER: FLOORSTANDING SUBWOOFER

Recommended: (1) RG6/Coaxial Cable for each subwoofer

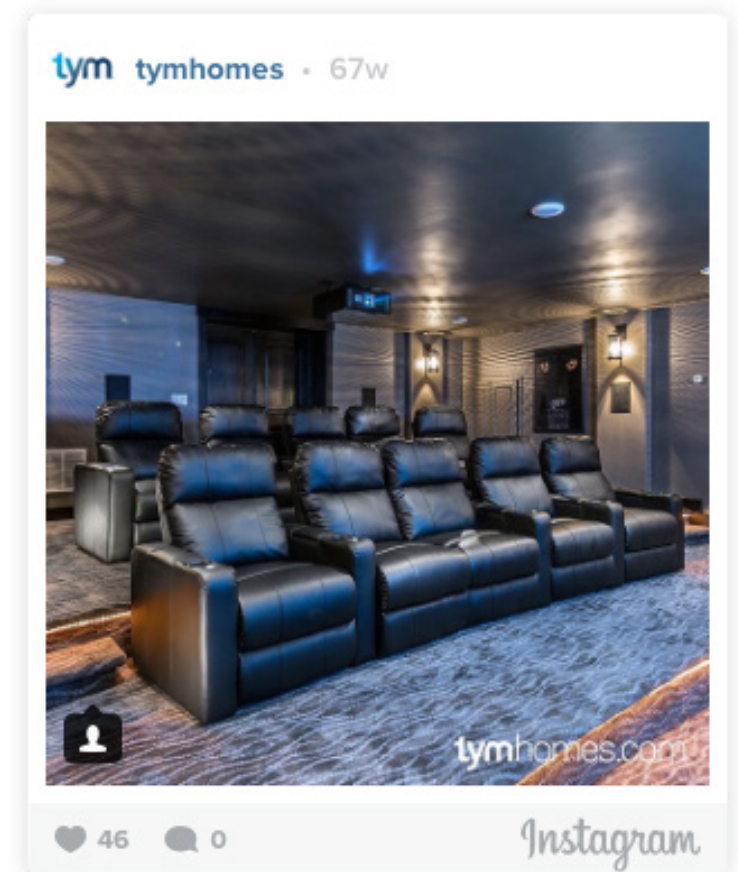
About the recommended:

There's no minimum here. Run (1) RG6/Coaxial cable for each floor standing subwoofer.

Subwoofer Cable Management – Use a single gang low voltage bracket at the location of the sub. I like to place the Subwoofer as close to the Subwoofer's outlet as possible so that the outlet is hidden by the Subwoofer.

In Cabinet, and Under Furniture Subwoofers – Certain manufacturers have designed subwoofers to go under furniture, or in smaller cabinets. You wire these the same way you would a floor standing subwoofer. If you place the sub in the cabinet, make sure the cabinet door is screened. Also make sure you have a power outlet in these locations to power the subwoofer.

Media Rack Cable Management – Run the RG6/Coaxial cable with the other speaker wires for the surround sound.



11 HOME THEATER: IN-WALL SUBWOOFER

Recommended: (1) 14/2 or (1) 16/2

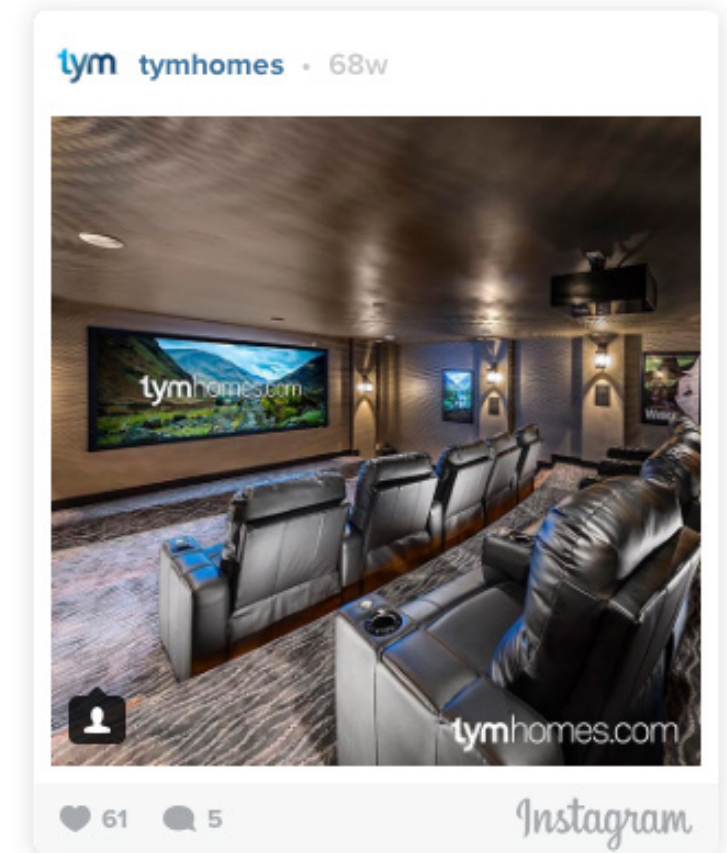
About the recommended:

There's no minimum here. Run (1) 14/2 or (1) 16/2 cable for each in-wall subwoofer.

Subwoofer Cable Management – For in-wall subwoofers you run the wire just like you would for a speaker. Higher end subwoofers have back boxes that require install before sheetrock. Other subwoofers require no back boxes and you can use Hanger Strap to place them. Make sure there's no electrical wire, plumbing or ductwork in the area you've selected for your in-wall subwoofer.

Subwoofer Locations – If the space requires it, you can place the in-wall subwoofers behind the screen. It has to be an acoustically transparent screen, but it works.

Media Rack Cable Management – Run the 14/2 or 16/2 cable with the other speaker wires for the surround sound.



12 SECONDARY SURROUND SOUND SYSTEMS

Recommended: (1) 16/2 per speaker

About the recommended:

We highly recommend running speakers for the critical TV locations in your home. As TV's get flatter, the speakers get weaker, and it's difficult to get volume from the TV's, let alone good sound. These surround sound systems could be full 5.1 systems, or simpler 3.1 solutions. In rooms like a gym, it could even just be two speakers in stereo.

We aren't suggesting you do a Surround Sound for every TV in the home, but consider doing it for your critical TV's. Places we regularly see secondary surround sound systems include the covered deck, great room, and master bedroom.

NOTE: Many Clients want to have their whole house audio speakers double for TV speakers. This can be done, but we strongly recommend against it. The user experience is best when the TV speakers, and whole house audio speakers remain separate.

Cable Management: For cable management, follow the notes on the main Surround Sound page for both speakers and the media rack.

More from Matt on this topic:



HOW TO PREWIRE SURROUND SOUND

Surround Sound isn't just for your 'Home Theater.' You can prewire for Surround Sound in your bedroom, the family room, or even outdoor spaces!

[READ MORE](#)



In-ceiling speakers create a 5.1 surround sound environment. (2 of the the speakers are for home audio)



In-ceiling speakers create a 5.1 surround sound environment for this remodeled living room.



In-ceiling speakers and an in-ceiling subwoofer create a 5.1 surround sound environment for this outdoor space.

13 DISTRIBUTED AUDIO: NO VOLUME CONTROLS



Recommended: There's no minimum here. Run (1) 16/4 to the first speaker, and (1) 16/2 from first speaker to the second speaker.

NOTE: 16/4 is a cable with (2) 16/2 speaker wires built into one cable. It's not required. You can run (2) 16/2 wires instead. The 16/4 is less wire to manage, and keeps the media rack looking cleaner.

Speaker Cable Management:

Speaker Brackets – Just like the surround sound speakers, you can use Speaker Brackets to place your speakers in the ceiling, or in the walls. This is a great way to make sure speakers are lined up with can lights, or wall fixtures. Speaker brackets are usually brand specific. So you'll need to choose speakers before you prewire.

Managing Cable for a Pair of Speakers – Run (1) 16/4 to the first of two speakers in the room. I take about 3' of slack and loop it. Then I use nail in staples, to lightly staple the loop above the speaker bracket or hanger strap. You want the staple firm enough that the loop won't fall during construction, but loose enough that you can easily pull it out when you install the speakers.

Pull (1) 16/2 from the first speaker to the second speaker in the room. Loop 3' of slack above both speakers as you did with the first speaker. Often the run between the speakers will sag below the ceiling beams. Use nail in staples, to tack the wire up so that it's safe from sheetrock.

NOTE: When you install the speakers you splice the 16/2 cable with

— TIP —

I want to leave a good 3-4' of slack so that it's easy to plug the wire into the back of the speaker at trim. Short wires, mean your trying to hook wires into the speaker with your hands over your head and low visibility. Do yourself a favor and leave some slack.



Audio prewire with speaker ring.



Special Single Gang Bracket, sits away from stud 1", and breaks away at install



Outdoor audio prewire with speaker ring.



Audio prewire with plumber's strap.

one pair of the 16/4 wire. You pull the loop out for both the 16/4 and 16/2. Place one pair of the 16/4 into the speaker's bindings. The remaining pair, you splice with the 16/2 wire. We use electrical wire nuts to splice the two pairs together. This is very standard practice in the space, and very acceptable. If you're concerned about effects on sound quality, you can always just run (1) 16/2 wire directly from the media rack out to each speaker.

NOTE: There's a special type of single speaker called a dual voice coil. It's designed to give you a stereo sound, even though you only have one speaker. It's basically two speakers crammed into one speaker. It still requires (2) 16/2, or (1) 16/4 because it's built like two speakers in one.

Media Rack:

Cable Management – If you are using (1) 16/4 cable management is very simple. Pull the cable through the 2" hole, on through the low voltage bracket and use the marks to measure and label. If you are using (2) 16/2, bundle the wires together like you do for TV's. This makes it easy to find both wires when it's time to wire them into the back of the amplifier. When you've completed the prewire, you want to bundle all the Speaker wires into one large Audio Snake.

— TIP —

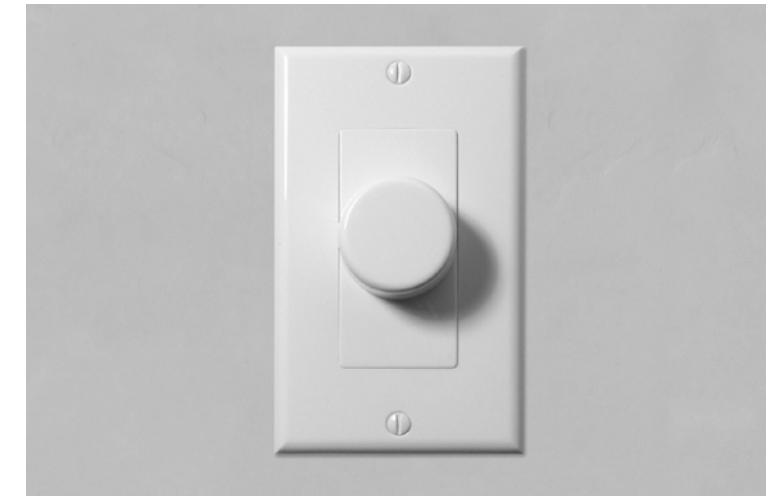
You'll often want to line your speakers up with can lights in the room. An easy way to keep everything in a straight line is to string a line across the center of your can lights. You can then center the speaker rings on that line, and it will keep your lights and speakers in a very straight line. You can measure, but walls are rarely square, so even measuring won't always guarantee you a straight line. So we like to string it off.

DISTRIBUTED AUDIO: WITH IN-LINE VOLUME CONTROLS



Recommended: There's no minimum here. Run (1) 16/4 to the volume control for the room, and (2) 16/2 out to the two speakers in the room.

What are in-line volume controls? Imagine two speaker wires running from an amplifier out to two speakers. Now place the volume control somewhere in the middle of those wire runs. The speaker wire coming from the amplifier, connects into one side of the volume control, and the speaker wire going out to the speakers connects to the other side of the volume control.



In-line volume control.

Volume Control Location – We typically place the volume controls at a height of 5,' and stacked above the room's light switch. There's really no right or wrong place to put your volume control. The goal is to make it look deliberate, and consistent throughout the home.

Volume Control Cable Management – Place a single gang low voltage bracket at the Volume Control location and bring the cable into location like you would for the TV's. You're going to have the (1) 16/4 coming into the volume control, and the (2) 16/2 going out to the speakers. Leave your self a solid foot of slack. You want plenty of slack to pull out of the bracket, when it's time to install your volume control.

Media Rack – With an in-line volume control, you're not pulling any additional wire. So follow the notes from the first section on managing cables in the media rack.

DISTRIBUTED AUDIO: WITH DIGITAL VOLUME CONTROLS

Recommended: There's no minimum here. Run (1) Cat5e to the Volume Control, (1) 16/4 to your first speaker in the room, and (1) 16/2 to the second speaker.

Digital Volume Controls are totally different from in-line volume controls. In fact you wire up the speakers like there's no volume control at all. You pull (1) Cat5e cable to the Digital Volume Control location. The speaker wire can go from the rack straight to the speakers. Not all systems are compatible with digital volume controls. Typically if you want Digital Volume Controls, you select your distributed audio system before you wire up the home.

Volume Control Location – Follow the notes from the In-line volume control page.

Volume Control Cable Management – You don't have speaker wires coming in, or going out. You only have the (1) Cat5e cable. Manage the cable like you would for a TV

Media Rack – With digital volume control, you're going to bundle the (1) Cat5e with the speaker wires it's corresponding with. Bundle them together, the same way you do a TV.



Digital volume controls.



Digital volume controls.

Recommended: There's no minimum here. Run (1) Cat5e for the Intercom keypad.

NOTE: This Cat5e, is separate from the Volume Control/Keypad Cat5e. So if you're running a Cat5e for Volume Control already, you need to pull a second Cat5e for the intercom.

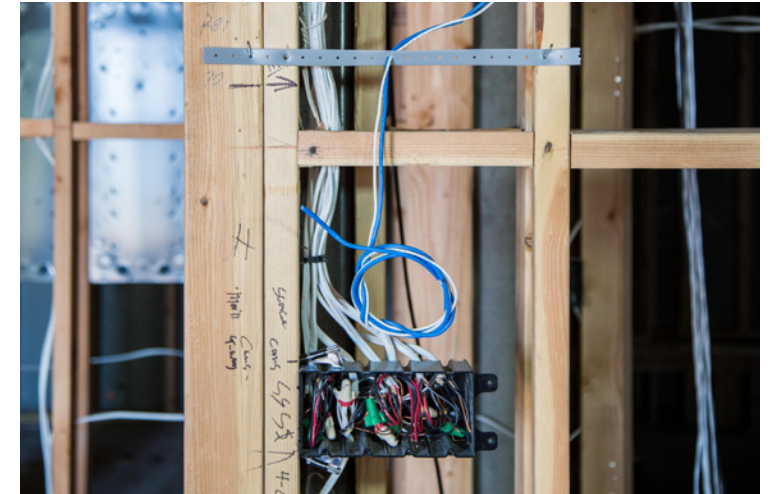
An Intercom keypad wires up exactly like a Digital Volume Control. So follow the notes on the Digital Volume Control for the Keypad location. The cable management at the media rack varies slightly.

Intercom Keypad Location – Follow the notes for a Digital Volume Control.

Intercom Keypad Cable Management – Intercoms typically require a 2-gang low voltage bracket. You need one gang for the keypad, and one gang for the speaker. If you're using a volume control as well, add an additional gang to your low voltage bracket for the volume control. Follow the digital volume control notes for cable management.

Media Rack – The (1) Cat5e for the intercom keypad is separate from the audio, so do not bundle them together. However, you want to bundle all the intercom keypad wires together when you've finished running all of them.

NOTE: There's a surprising amount of variety in Intercoms. You should consult the intercom installation guide before prewiring. For example, if you're intercom requires an inwall single gang speaker, you may need an additional wire for that as well.



Intercom prewire centered above electrical.

17 DEMARCATION

NOTE: The Demarcation, or Demarc for short, is the place on the exterior of the home where the Internet and Cable providers bring their wire. Usually there is a conduit stubbed up near the power meter, that allows your Internet and Cable providers to bring their cable from the curb to the side of your house. To bring the Internet and Cable into the home, you need to run wire from the Demarc back to the low voltage panel.

Recommended: (2) Cat6, (2) RG6 Coaxial Cable, and (1) 18/2

Every Internet and Cable provider is a little different, especially when you start talking about fiber. It's unlikely that you'll use all 5 wires, but it's very difficult to know for certain which wires you'll need.

Minimum: You can use fewer wires here, but I honestly recommend against it. We've seen too many situations where the Demarc was inadequate for the available service providers in the area. The Recommendation above has yet to fail us.

Demarc Location – Assuming there's conduit at the side of the house, you want to pull the cables through the exterior of the house so that they come out right on top of the conduit. I like to pull the wires through 6-12" above the conduit. If there's no conduit, place the Demarc on the side of the electrical panel that is closest to the back of the house. That reduces the visibility and keeps it looking cleaner.

Demarc Cable Management – Leave several feet of slack, but cut the wires short enough that they can't touch the ground. This way when the wires are uncoiled, they won't sit in the mud or water. Roll the wires up into a coil, and tape them.

— TIP —

Contact your local service providers, and ask them for their recommendations as all service providers requirements for the Demarc vary. With fiber, every company does it differently, so make sure the company you call is the company you're really going to use.

Low Voltage Panel – Bring all the wires from the Demarc into the left side of the low voltage panel. Measure the cables, and cut them to length.

NOTE: If you're particularly precious about the esthetics on the exterior of the home, you can use cable here that's colored to match, or blend in well with the exterior of your home.



Place a low voltage bracket at equal height to the electrical outlet.

18 SATELLITE PREWIRE

Recommended: (2 - 4) RG6 Coaxial Cables, (1) 18/2

This is a rule of thumb, but you should contact your local Satellite provider for requirements. As a general rule, you run (2) RG6 cables if you want fewer than 4 satellite receivers in the home. You pull (4) RG6 if you want more than 4 satellite receivers in your home. The 18/2 is used in snowy climates, and is used to power a heater to melt the snow off your satellite.

NOTE: A satellite prewire runs cables for your Satellite up to the soffit of the home. It prevents the satellite company from stapling wires around the side of the home. A technique referred to as 'wrapping the home.'

Satellite Location – You should check with your local Satellite TV provider, but the rule of thumb is to place the Satellite in a place that faces Texas. In the past you could run the wire to the attic, and the Satellite installers would handle it from there. Today, many installers are refusing to go into attics. So you run the wire to a location in the Soffit closest to the area of the Satellite.

Satellite Cable Management – Use a single gang low voltage bracket and place it in the soffit. Pull your satellite prewire to that location. You don't need to staple this one, or secure it. Just coil up 2-3' of cable, and let it rest above the low voltage bracket.

Low Voltage Panel – Bring the cables for the satellite prewire into the left side of the low voltage panel. Measure and cut them to length.

NOTE: Consider a color of wire that blends in with your exterior.



Satellite prewire bundle.



Satellite prewire bundle next to surveillance prewire.

19 SATELLITE INTERNET



Recommended: Consult with your local Internet provider.

We know. That's a bit of a cop-out, but we want you to be aware that Satellite Internet is something you may want to prewire. Especially in newer developments, there are times when Satellite Internet is the only option.

After you talk to your Internet provider, you prewire Satellite Internet the same way you would the Satellite TV. So follow the notes in the previous section.

Note: The Satellite Prewire can't double as your Satellite Internet prewire. They're two different things.

20 SURVEILLANCE

Recommended: (1) Cat5e or (1) Cat6, (1) RG59 Siamese Coaxial Cable

Minimum: (1) Cat5e or (1) Cat6

About the recommendation:

IP Cameras require a Cat5e or Cat6 wire. Both power and video can be sent over the wire to the camera. Analogue cameras require a RG59/Coaxial cable, and an 18/2 for power (you can also use a RG59 Siamese Coaxial Cable that has both the RG59 and 18/2 bundled in one cable). If you run both a Cat5e or Cat6, and a Siamese cable, you leave your options open for any type of camera you could ever need.

Camera Location – We recommend placing cameras in locations that can be reached with a normal size ladder. Eave's and dormers require you to get on the roof for service, or to rent an extension ladder, and they rarely provide better coverage. You can place the cameras in the soffit, or on the side of the home.

Camera Cable Management – Place a single gang low voltage bracket at the location of the camera. Leave yourself 3-4' of wire bundled up above the low voltage bracket.

Cable Management For Interior Cameras – Not all cameras are large enough to cover the wall plate. On the exterior of the home, this usually looks ok, but it often bothers people for interior cameras. If you're concerned about the camera covering the wall plate, use the hanger strap, and place the camera wire like you would a speaker wire. Then the cameras can mount directly to the sheetrock and without worry of covering the wall plates.



Surveillance prewire for 2 cameras.



Indoor surveillance camera prewire



Media Rack – Bring the camera wires into the Media Rack. Use your marks to measure and label the wires. You want to bundle all the camera wires into one snake like you do with TV's.

21 HOME SECURITY



For home security, you're going to run different wires for different sensors. We'll list them below, and include cable management tips specific to each sensor there. All the security wires go back to the right side of the low voltage panel.

Security Keypads: Run (1) 22/4 security wire from the right side of your low voltage panel, to the Security Keypad location.

Location – We typically place the keypads in the Mudroom, and Master Bedroom. We place them at a height of 5' and typically stacked above the light switch for the room

Cable Management – Use hanger strap to poke the wire out at 5'. The wire runs back to the right side of the low voltage panel.

Motion Sensors: Run (1) 22/4 security wire from the right side of the low voltage panel, to the motion sensor location.

Location – Optimum height on the wall is 7'. We usually place motions in the corner of rooms like the Great room. Do not place motion sensors in the garage, or in areas that are facing up a flight of stairs.

Cable Management – In corners of rooms, place a nail into the corner of the studs, and wrap the motion wire around the nail. The drywall contractor knows to pull this wire through the wall. For ceiling mount motion sensors, use a one gang low voltage bracket, or hanger strap to place the motion. Run the motion wire back to the right side of the low voltage panel.



Keypad prewire held with hanger strap.



Keypad prewire held with hanger strap.



Wire shown for a 3/8" door sensor.

Glass Break Sensors: Run (1) 22/4 security wire from the right side of the low voltage panel, to the glass break location.

Location – Glass breaks can mount to the ceiling or wall, but are typically ceiling mounted. They cover visible windows within 15.’

Cable Management – Wire management is the same as motion sensors, see notes above.

Window Sensors: – Run (1) 22/2 security wire from the right side of the low voltage panel, to the window sensor location.

Location – Window sensors have two parts, a switch, and a magnet. The magnet attaches to the window itself. The switch attaches to the frame of the window. You normally attach the switch to base of the opening side of the window frame. Somewhere that makes it as low profile as possible. The closer it is to the edge of the window frame, the less you’ll see the wire.

Cable Management – The wire pulls through the window casing, rests just in front of the window frame, and at the location of the switch. You run the wire back to the right side of the low voltage panel.

NOTE: As a general rule, window sensors do not work with crank windows.

Door Sensors: Run (1) 22/2 security wire from the right side of the low voltage panel, to the door sensor location.

Location – Hardwired Door sensors come in several varieties, but the install is essentially the same. You need to know in advance the type of door sensor you're going to use. See notes below. You drill a hole in the frame of the door, and pull the 22/2 through the hole.

Cable Management

Types of Sensors:

3/8" Press fit – this is a small 3/8" sensor. You use a 3/8" drill bit, to drill the hole anywhere on the frame of the door, and pull the wire through. On the door you drill a matching 3/8" hole into the door, and press a magnet into the door.

Plungers – this is similar to a press fit, but there's no magnet. It has to go on the hinge side of the door. It takes a 3/4" hole, and you pull the wire through the hole. With Plungers it's best to install during the prewire. That way you know for sure the hole is deep enough to fully recess the sensor into the frame of the door before the sheetrock is up.

Siren: Run (1) 18/2 to the siren location, and back to the right side of the low voltage panel.

Location – This is really a matter of opinion. You can place the siren pretty much anywhere you like. You just want to make sure it's somewhere you can hear the siren. In new construction, we often place it next to the doorbell.

Cable Management – Use a single gang low voltage bracket, and place the siren wire like you would for a TV. Run the wire back to the right side of the low voltage panel.

— TIP —

When in doubt, if you aren't sure what wire to run for security, run a 22/4. It will work for you more often than not.



Siren prewire.

22 HOME NETWORK



WiFi Hotspots: (1) Cat5e or Cat6 per Hotspot

This is one of those areas where it pays to be aggressive. It's a good practice to cover opposite ends of the home, but it doesn't hurt to wire up a number of options for yourself. Hotspots can mount to the ceiling like a Smoke Alarm, or they can rest on a shelf.

We'll hide them in linen closets, laundry rooms, pantries, media cabinets, etc. When you move into the home and start setting up your wifi network, it's nice to have options. If one configuration of hotspots doesn't quite cover the home, you can always move hotspots around, or add more as needed. So be aggressive with your prewire here.



Closet ceilings are excellent for hotspots.

NOTE: If you place your Hotspot in a closet, be sure there's room for you to get to the ceiling. Some linen closets, don't have enough room for you to squeeze between the shelves and the door to reach the ceiling.

Ethernet (Hardwired Network): (1) Cat5e or Cat6 per location

You have the obvious spots in the home that benefit from a hardwired Ethernet connection like the phone, computer, fax, etc. There's some other locations you might wire up Ethernet just to be safe like behind major kitchen and laundry appliances. With Smart Home fridges ready for market, it's not too far out before you'll want to be able to hardwire your Smart Fridge into your network.

NOTE: Cat5e and Cat6 are wonder wires. You can convert them into almost any type of wire and use that you need with proper converters on the ends. So as you're prewiring your home, it never hurts to add more Cat5e or Cat6 into a

room or location. If you think you might need it, go for it.



23 MISCELLANEOUS



This last section is for all the one offs, things like iPad wall mounts, lighting control, blind control etc. So without further ado, the Miscellaneous section.

iPad Wall Stations – There are a variety of iPad stations. Some are in-wall, and some are charging stations that the iPad easily snaps off of. The wiring requirements vary one wall mount to another. We run (1) Cat5e, and (1) 18/2 to each location to be safe. When the iPad is near a light switch, we prefer to stack it above the light switch at a height of 5'. Otherwise anywhere you like to place it on the wall will do. Run the wire back to the right side of the Low Voltage Panel

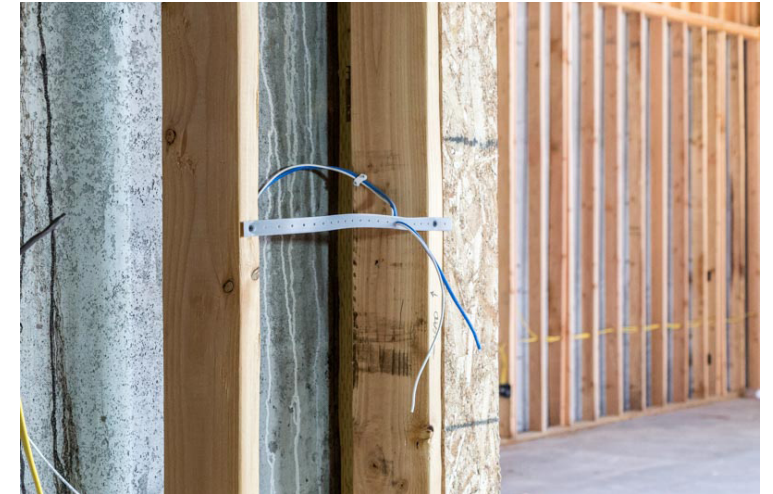
Use Hanger Strap, rather than a Low Voltage Bracket. The iPad Mount isn't large enough to cover the bracket, so hanger strap is best.

Tablets – Many systems like Control4 offer their own Android Tablet with some extra bells and whistles. It's a good idea to verify the manufacturer requirements, but again a safe bet is to run (1) Cat5e, and (1) 18/2 to these locations.

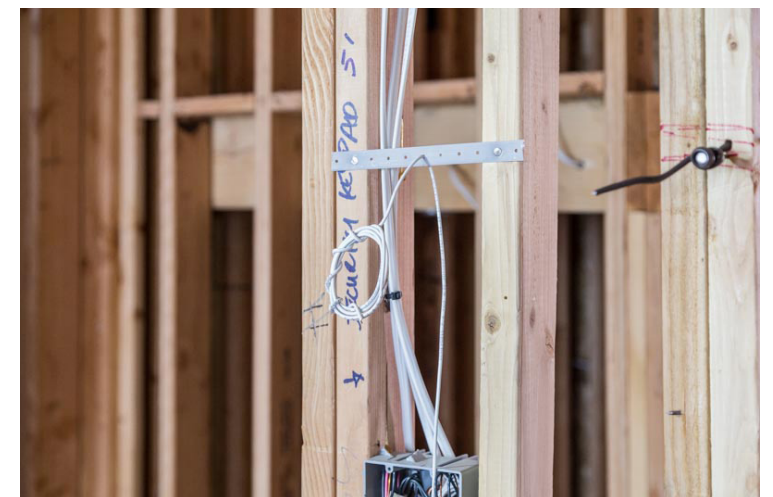
Here you should know what system you're using, and you want to follow their instructions for a mounting plate to nail into the studs during prewire. Run the wire back to the right side of the low voltage panel.

Door Bell – It's best to let the Electricians wire up the Doorbell the same way they always do, because a portion of the Doorbell requires high voltage. But if you want the Doorbell to tie into the Audio system, run (1) Cat5e from the Doorbell back to the Audio section in the Media Rack.

Fireplace – If the fireplace is switched with an electrical switch, you can normally tie



iPad or Keypad at 60", centered above lights.



Hanger Strap to hold the wires in position.



Fireplace control prewire.



Doorbell prewire.

into it. Run (1) 22/4 from the Fireplace switch box, back to your Media Rack.

Blinds – Most of your blinds are going to be wireless. Unless the blind specifically calls for it, you usually only prewire blinds in locations that will be tough to reach to change batteries later; like the windows in a vaulted Great Room. A low voltage power wire like (1) 18/2 will take care of it. You run the wire to the top corner of the window opening. There's no way to conceal the wire, you just leave a small piece poking through the sheetrock. Run it back to the right side of the Low Voltage Panel.

Hidden Blu-ray players – It's not as exciting as it sounds, but if you are wiring everything to a Media Rack, you may not want to walk all the way across the home to the Media Rack to load your 4K Blu-ray into the player. So you can hide a blu-ray player in the Master Bedroom Closet, or the Kitchen Pantry. Run (2) Cat6 from the Blu-ray player location back to the Media Rack. To be safe, we like to run (2) Cat6 from the Blu-ray player to the TV you want it to play to. The Cat6 running back to the Rack will allow you to pipe the Blu-ray through the Smart Home system.

Serial Connections – Many items integrate through a 'Serial Connection.' This is a fancy word for a hardwired connection that usually runs over Cat5e. As we get to the end of a prewire, we usually run Cat5e to several locations where there's a chance of integrating with 'Serial' later.

Repeaters for lighting systems like Lutron's repeaters, High end HVAC systems, outdoor lighting systems, Hot tubs and



Pools, Water falls and water features, sprinkler systems, garage door openers, etc.

Sometimes we don't know for sure if these systems will integrate with the particular system we're installing in a home, but to be safe we'll pull some extra Cat5e. I've never regretted pulling a little extra to future proof the home on the other end.

Anything for a serial connection is best pulled back to the Media rack.

24 GENERAL NOTES



These are general guidelines for placing and managing cables. Feel free to do it differently, this is just a list of tips that have helped us and our technicians make placement look deliberate and consistent throughout a home.

STANDARD HEIGHTS:

- Keypads, iPad Mounts, Thermostats, Volume Controls, Intercoms, etc., - Place at a height of 60'
- Security Motion Sensors - Place at a height of 84", or 7'
- Wall Mounted TV's - Place the Low Voltage Bracket and Outlet at 72". This gives the TV room to mount comfortably underneath the outlets and low voltage bracket.

LOCATIONS:

- Keypads, iPad Mounts, Thermostats, Volume Controls, Intercoms, etc., - stack directly above light switches.
- Motion Sensors - in corner of rooms to give greatest angle of vision (do not place so they're aimed up stairs, or in garages)
- Surveillance Cameras - Place cameras where they're accessible by regular height ladders, preferably in the soffit of the main level of the home. When wall mounting, line camera height up with sconces on side of the home.
- Audio Speakers - think about where you're most likely

to be standing or sitting when you're in a given room. Speakers ideally should be placed on the left and right sides of that location. This gives the optimum stereo sound effect. Ex: in bedrooms we usually place speakers on left and right sides of the bed.

WIRE MANAGEMENT:

- Low Voltage Brackets - for items requiring a Low Voltage Bracket, we like to place one staple around the cables at the first edge of the low voltage bracket the cables run past. We cut the cables about 8-10" longer than the end of the low voltage bracket, and place a loose staple near the end of the cables. Just enough to keep the cables from swinging out from the stud bay and getting caught by sheetrock. This protects the cables, but makes it easy to pull the cable through the mudring at trim-out. Some companies like to coil the cable, and ziptie it to the wire tie hook on the low voltage bracket. Either approach will work.

HANGER STRAP:

- Items that need hanger strap, Keypads, iPad Mounts, etc. Stretch the hanger strap across two studs, or in the instance of speakers, strap them across the ibeams. You can use Screws, or staples to fasten the strap to the wood. The advantage of the hanger strap is it allows you to place the wire exactly where you

want it. So you can center the keypad wire above the light switch, or center the speaker wire between the ibeams.



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25 GLOSSARY



HEAD-END The starting point of cable runs. Usually this is your hardware, like Amplifiers, Receivers, A/V Switches, Low Voltage Panels, etc.

DROP One run of cable, from the head-end to the termination point. This includes all forms of low voltage wire, speaker wire, data, coaxial, and low voltage power wires.

DEMARCATCION (also called Demarc) The location on the exterior of the house where Cable and Internet Services connect to the home. It's usually located next to the electrical meter.

LOW VOLTAGE PANEL A metal box, that houses some of the cables in the home. It's typically used to house the Services coming into the home from the Demarc, and Satellite prewires, but can also be used to house Network Cables, and Coaxial Cables for TV.

LOW VOLTAGE BRACKET (also called Mudring) Used to place wires for TV's, Data/Ethernet ports, Cameras, etc. It's similar to an electrical box, but not enclosed.

HANGER STRAP This is a vinyl strap found in the plumbing section of Home Depot and Lowes. We use it to place Keypad Wires, iPad Mounts, and speakers.

SPEAKER BRACKETS These are cutout rings, that you place in the ceiling at the time of prewire. Sheetrock crews cut them out like they would for can lights. Your speakers fit inside, and attach to them at trim out. It's optional, but makes for quicker trim-outs.