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Exterior Wiring

This section provides information on basic building construction and methods of drilling, attaching, and routing video cable to and through the exterior of a building. The Module describes the following:

- Building construction
- Exterior cable routing
- Cable entry-drilling
- Installing an amplifier
- Building Construction

A field technician will encounter many construction styles and materials for residential and commercial buildings that he/she is required to install video cable to. In order to safely complete the installation in a timely manner and to ensure that the customer is satisfied with the overall appearance of the installation, the technician must be familiar with various construction practices to determine the best method of wiring for each application. It is just as important that the right tools for the job are used, to ensure success. Perform each installation as you would at your own house.

Residential Construction

Residential homes are typically composed of a wood frame, brick, or even stone construction. Additionally, there are a variety of exterior facing materials used, including wood, slate, aluminum, vinyl, stucco, brick, and stone veneers. Each style can be challenging and may require different types of tools and fasteners to complete the installation.

Always plan your cable routing prior to attaching the cable and/or drilling into the building. It is important that you identify and locate the following areas of the customer's home to include them in your routing formula:

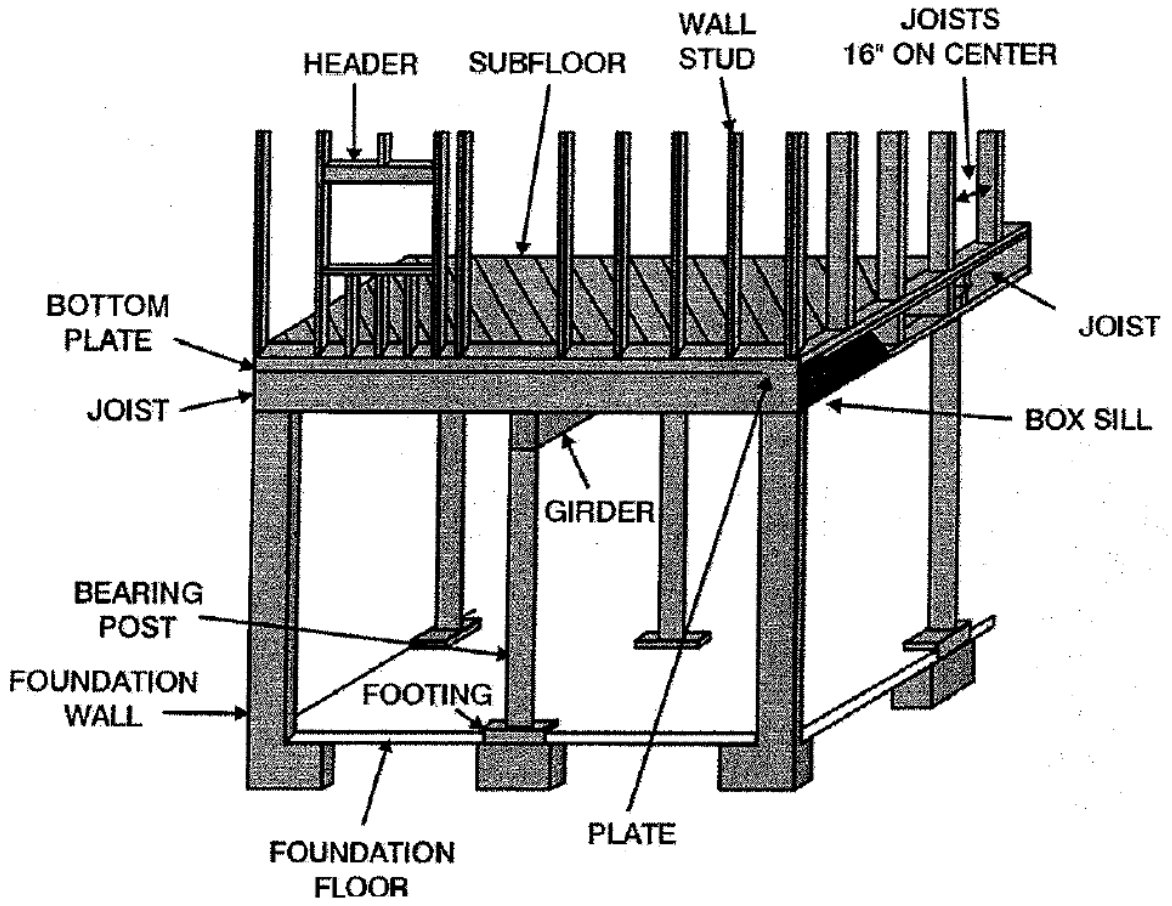
- Basement or cellar
- Crawl space
- Walls
- Ceilings
- Attics

Spend the extra time necessary to become familiar with your customer’s dwelling before actual installation. This will help establish a sound game plan, identify the required tools for the job and ensure that the job is completed correctly the first time with few surprises. This practice will save a significant amount of time and reduce the change of customer callback for rework.

Basement or Cellar

Basement walls are usually constructed of poured-place concrete (with rebar for structural support), concrete or cinder blocks and mortar, and in the case of some older homes, stone and mortar. In most cases some sort of waterproof coating is applied to the outside of the basement walls to prevent water leakage into the basement. Usually, the basement walls extend above the level of ground to prevent the wood framing of the house from coming in direct contact with the earth.

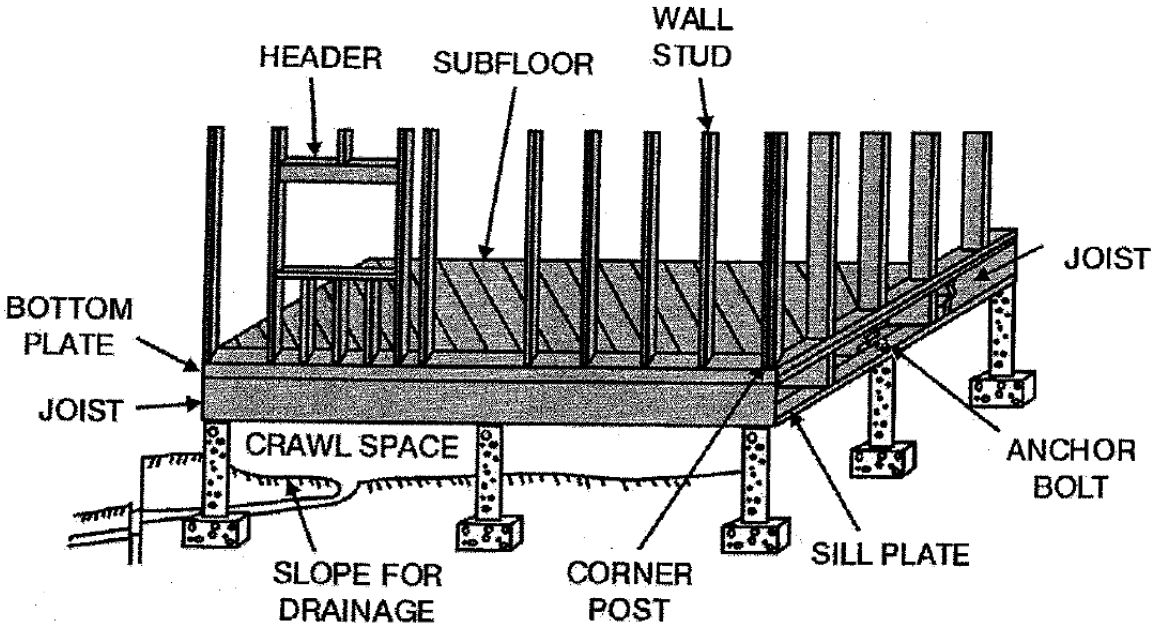
Basement interior walls may be unfinished concrete or stone, painted, or covered with wallboard, paneling, etc. depending on whether or not it is a finished basement. In the case of a raised ranch, the lower level (basement) is actually used as a finished living space with an egress to the outdoors.



Typical Basement Construction

Crawl Space

Crawl spaces are unfinished areas under the building normally 3 to 4 feet in height. The walls are usually constructed of unfinished concrete or cinder block. In some cases, there may be a poured, unfinished concrete floor. The floor is normally earth, possibly covered with sand and/or aggregate. In many cases where moisture is a problem, the crawl space floor will be covered with some form of plastic or moisture barrier. The ceiling of the crawl space is normally the underside of the flooring from the first level and floor joists used in the construction.



Typical Crawl Space Construction

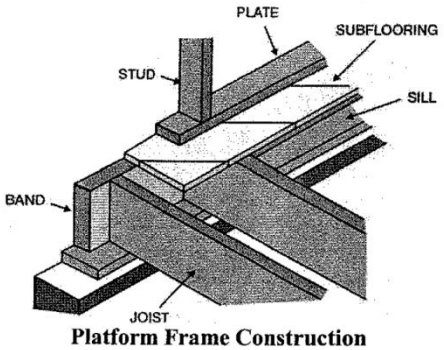
Working in confined spaces poses a threat of bodily harm to the technician. Confined working conditions are awkward to maneuver in. Dangerous conditions may be present in crawl spaces. They include: insects, rodents, asbestos, insecticides, leaking sewer pipes, etc.

Working in a crawl space can pose several safety issues regarding the tight working space and opportunity to hit your head on flooring joists. It is usually not the cleanest workspace, so Connect/One will provide crawl suits to the field technicians. It is also a good practice to remove these dirty clothes prior to entering the customer's house for the interior wiring portion of the installation.

Typical Home Construction Styles

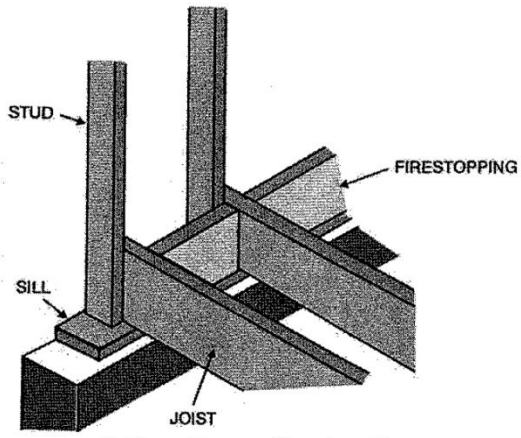
Platform and balloon frame construction are two common types of residential home frame construction. Knowledge of these basic construction styles is important when determining the possible spaces where video cable can be run. In either style, the wall studs, piping, and electrical cabling normally run vertically.

Platform frame construction begins with a sill attached flat to the top of the foundation wall and secured with anchor bolts, washers, and nuts. Next, a band is attached on the edge of the sill; the band is used as an anchor point for the floor joists. A subflooring (planks or plywood sheets) is attached over the band and floor joists. The wall assembly is then attached to the subflooring using a plate with vertical wall studs.



Platform Frame Construction

Balloon frame construction also starts with a sill attached to the foundation wall, but no band is used as an anchor for the floor joists. The wall studs are normally nailed directly to the sill, and each floor joist, in turn, is attached to the vertical wall studs. In many cases, wooden planks are attached on the edge between each floor joist and nailed to the joist and the wall stud. This is commonly called a firestop.

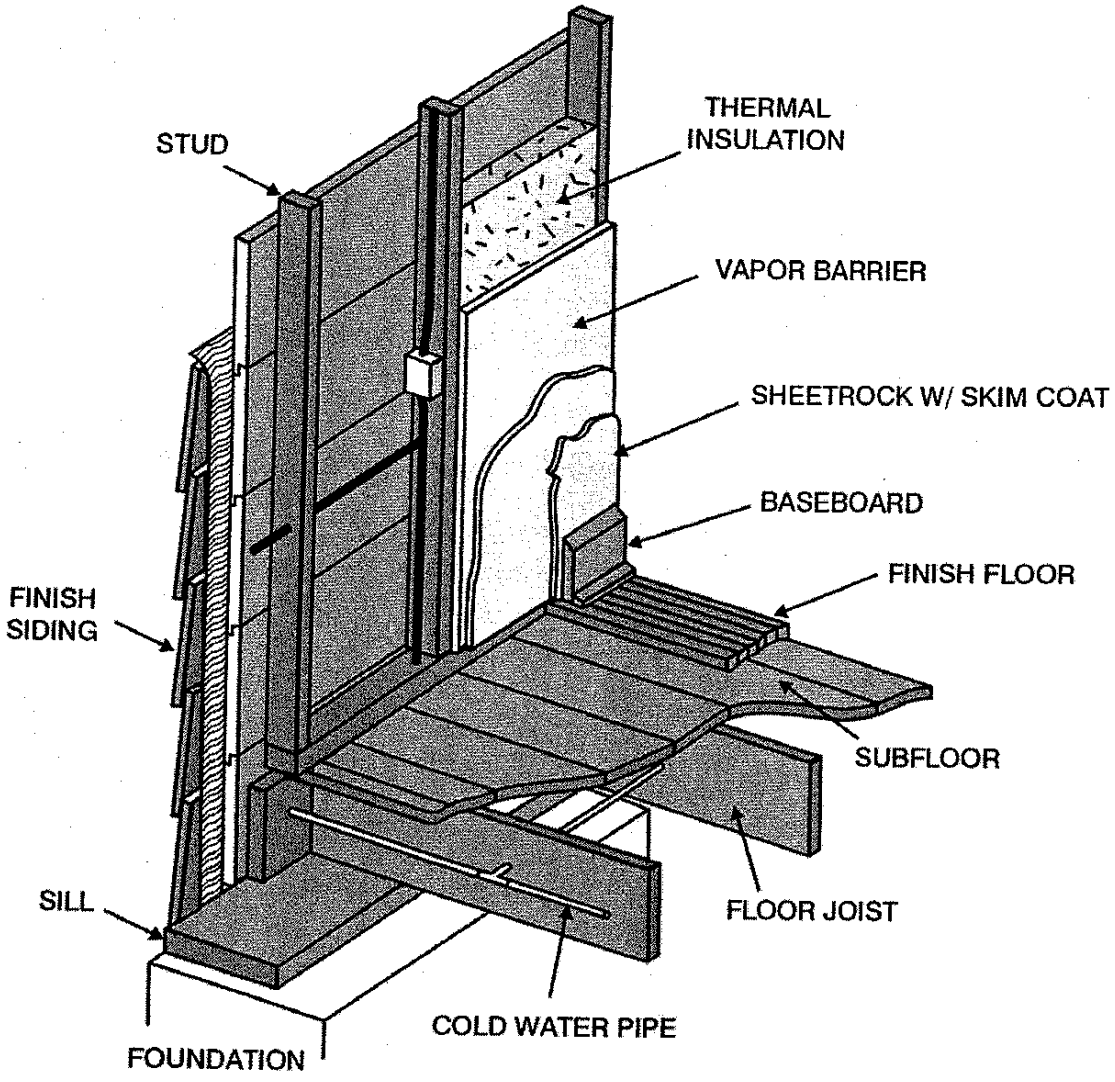


Balloon Frame Construction

The best place to determine each particular style is usually from inside the crawl space or an unfinished basement.

Walls

Outside walls are normally built of 2 x 4 lumber called studs and rest either directly on the sill or a plate, depending on the frame construction style. In most cases (depending on the age of the home and local building codes), these studs are placed on 16-inch centers. The distance between the center of one 2 x 4 stud and the center of the next stud is 16 inches. Some newer, more energy-efficient homes use 2 x 6 studs to allow for more space between the outside walls in order to make room available for additional insulation. When this design is used, building code usually allows for 24-inch centers rather than the normal 16-inch centers. Knowing the location of the studs is important so as not to attempt to drill through them. This practice is time consuming and will weaken the stud.



Typical Wall Construction

Interior and exterior walls will most likely contain some form of obstruction that each technician needs to be aware of. These obstructions include:

- Insulation
- Electrical wiring
- Plumbing
- Heating and cooling air ductwork
- Alarm systems and associated wiring
- Telephone or communications wiring

Outside walls seldom contain air ductwork due to heat transfer concerns, but an inspection of the basement/cellar or crawl space will confirm whether any ductwork actually exists.

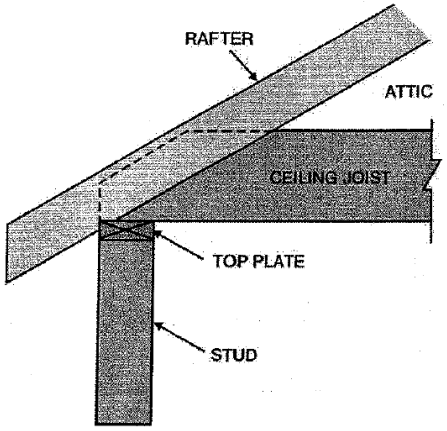
In addition to the various types of exterior wall coverings discussed earlier in this Module, interior walls can be covered by numerous types of coverings. The most common types of interior wall coverings encountered are as follows:

- Drywall (also called sheetrock, plasterboard, or wallboard)
- Wood paneling (either solid wood or sheets)
- Plaster walls (usually found in older homes)

Plaster walls are made up of spaced wooden slats sometimes covered with lath that has plaster laid over it. This type of wall is extremely fragile and difficult to repair. When drilling through the plaster, the technician may note that the drill will tend to spring back once contact is made with the wooden slats and wire.

Ceilings

Ceiling joists are attached across the wall's top plate and are used to support the rafters as well as any flooring on top of the joists. Flooring on top of the joists is found in walkthrough attics and especially in the Cape Cod style homes that use the space above the joists as a half-story living space. Ceiling joists are normally 2 x 6 or larger and spaced on 16-inch centers.



Ceiling/Attic Construction

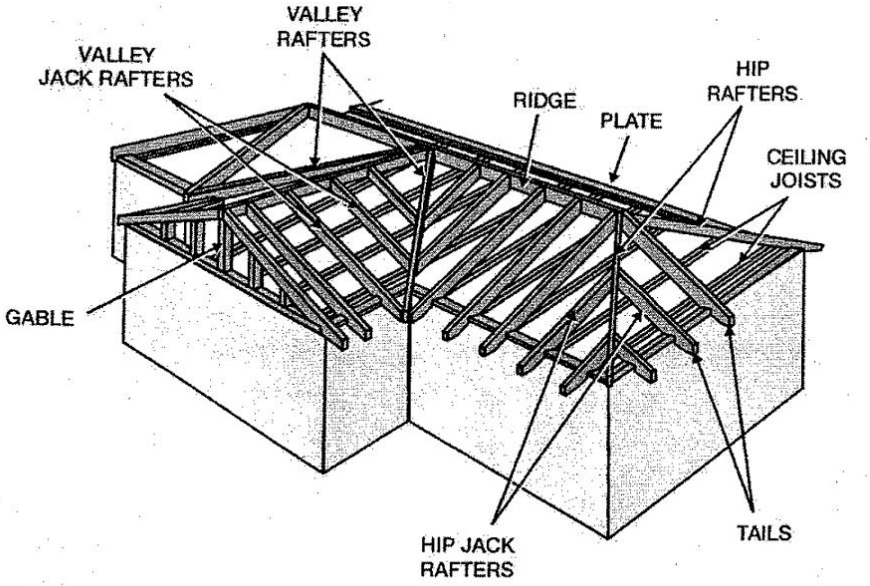
Where no flooring is used above the ceiling, trusses might be used. These trusses are triangular in construction and incorporate the joist, rafter, and any associated bracing materials all in one. Trusses are usually constructed of 2 x 4 lumber and are spaced on 24-inch centers. The most common ceiling styles include the following:

- Drywall attached directly to the ceiling joists or trusses. Normally painted or covered with textured material.
- Plaster ceilings may be found in older homes and are similar in construction to the previously described plaster walls.
- Drop ceilings use small metal runners or brackets suspended from the ceiling joists. The brackets create a grid that holds individual sound-absorbing panels. These panels merely rest within the brackets and are not normally permanently attached to the grid. Access to the space above the ceiling panels can be achieved by gently lifting straight up on the panel and moving it to any side.

Attics

The space between the ceiling joists and the rafters usually forms the attic. This is not normally the case with Cape Cod style homes. This space is normally used as additional living space. Some attic space may be found at the outer edges of the load-bearing walls. This can be all excellent spot to route cabling for upper story rooms.

Care must be taken when routing cable through the attic space. Where trusses are used instead of ceiling joists, chances are good that no flooring is present. In most cases, the technician will encounter some form of insulation placed directly onto the ceiling drywall or plaster. During the summer months it may also be extremely hot in these attic spaces.



Typical Attic Construction

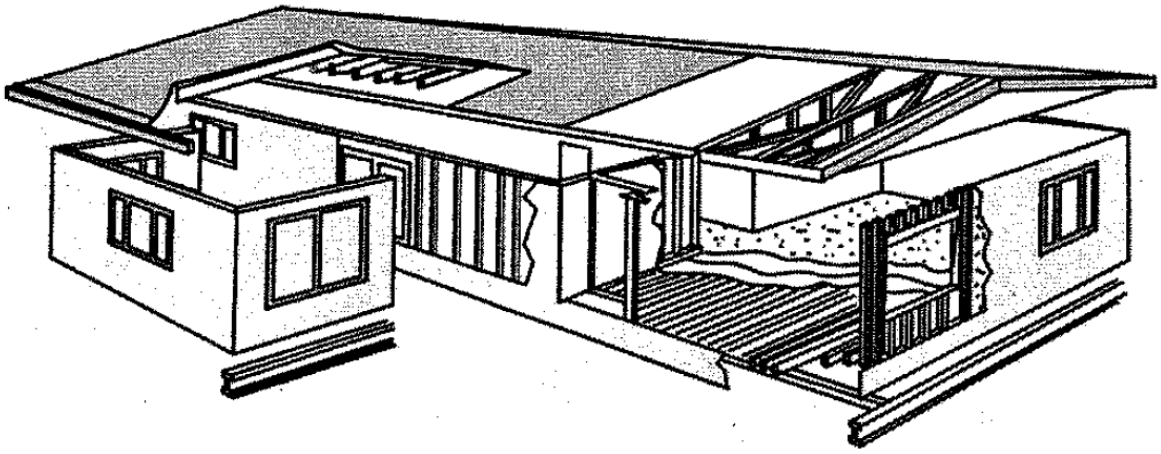
Working in attics without floors creates a potential fall hazard and damage the customer's ceiling. Loose insulation can damage the respiratory tract.

Because the insulation is in direct contact with the air space in these types of attics, it is recommended that a face mask be used by the technician to prevent inhaling insulation particles. This is especially true for blown-in insulation materials. If no flooring is encountered within the attic space, take care to place your weight only on the ceiling joists. Any significant pressure on the exposed ceiling material will cause damage to the material and present a fall hazard for the technician.

If the insulation is thick enough to hide the ceiling joists or trusses, gently move the insulation to one side to expose the joist before moving through the attic. Due to the irritant nature of most insulation materials, it is highly recommended that the technician wear gloves prior to handling insulation. Once the work is complete in the attic, always ensure that the insulation is returned to its original location before exiting.

Mobile Home Construction

While the general construction style of mobile homes is similar to conventional homes, mobile homes commonly use steel or aluminum joists and studs attached to a steel frame. There is always a potential for the entire home to be energized. Also, the wiring encountered in a mobile home usually runs horizontally, not vertically. In this case, it is extremely important to check whether wiring exists on either side of an outlet rather than above or below it.



Mobile Home Construction

The metal frame on mobile homes can be energized.

Commercial Construction

Most commercial buildings are not constructed like residential homes. Commercial buildings are usually constructed using steel beams and concrete blocks for the superstructure. Drop-type or false ceilings are also extensively used. In some commercial buildings, the space above the drop or false ceiling contains or is actually part of the building ventilation system. When running cable through these areas, a plenum-rated cable must be used if installed without conduit.

Exterior Cable Routing

Once the technician is thoroughly familiar with the building construction and has formed a plan for the routing of cable, cable attachment and exterior entry can begin. It is not always the quickest or shortest route that will attain the most professional job. A lot of consideration must be given to the overall appearance of the cable route once the job is done. This will ensure ultimate customer satisfaction and gain a superior experience rating for the technician. This section will illustrate the types of fasteners, tools, and techniques needed to attach cable to different exterior surfaces. It will also show the tools and techniques for entry into the building, ending at the wall plate.

Review of Techniques

Dos and Don'ts for attaching cable to exterior surfaces are as follows:

- The drop cable is not spliced between the tap and the bonding block or between the bonding block and the entry point into the building.
- The entry hole for video cable must always use its own hole. Do not use existing entry holes used by telephone or electrical cabling. Never drill holes through window frames. Do not run cables through windows, doors, or vents.
- Do not over tighten tie-wraps or messenger cable wraps because they can cause cable damage and signal deterioration.
- Ensure that all cable connections, with the exception of connections to the customer's equipment, are properly torqued using a calibrated torque wrench or are tightened to 1/6 turn past finger tight. This will reduce the possibility of signal leakage from the connections.
- Never use any wrench when tightening to make cable connections to the customer's equipment. This will reduce the chances of damaging the customer's equipment.
- Ensure that the cable and its components are attached and routed sufficiently away from high heat sources and moisture. In addition to high heat and moisture, the technician must ensure that the cable is routed sufficiently away from power cables to reduce the possibility of electromagnetic fi ld (EMF) interference.

Selecting the Proper Cable Fasteners

As discussed earlier, many types of building sidings are found in the field. In order to provide for the secure attachment of cable while not damaging the customer's building and presenting a professional appearance, specific fasteners are required for various surfaces.

The surfaces discussed in this section include the following:

- Wood
- Shingles
- Aluminum siding
- Vinyl siding
- Stucco

Wood

Always use nail-type fasteners inside and screw-type cable fasteners outside when attaching cable to wood siding. The most common fastener used for wood siding application is called the cable clip. These clips are made by several different manufacturers and use a nail as the fastener for attaching to the building.

Care should be taken when driving the nail into the surface so as not to impact the cable with the hammer. Striking the cable could cause damage and might require that the entire run be replaced. Always maintain the minimum and spacing distances of 16 (minimum) to 24 (maximum) inches for horizontal runs and 24 (minimum) and 36 (maximum) inches for vertical runs.

Shingles

Many types of siding shingles are used today. Care must be taken to determine if the shingles contain asbestos. Asbestos poses an airborne hazard especially when the fibers are small.

Overexposure to asbestos fibers can severely affect your health.

It has been determined that asbestos is a carcinogen (cancer-causing agent). Overexposure to asbestos fibers can lead to pulmonary fibrosis and asbestosis.

Some of the shingle materials a technician might encounter are as follows:

- Cedar
- Slate
- Other types of wood or wood composites

Cedar and slate shingles are particularly fragile. Screws or nails driven too close to the edge may cause cracking and/or splintering of the shingle. A small pilot hole can be drilled into the surface prior to screwing or nailing the clip into place. Avoid this practice, if possible. A different cable route might be considered to avoid drilling into these surfaces (basement or crawl space).

The installation process for attaching cable to shingles is as follows:

- When using drive pin rings or nail clips, use the joints between the shingles to drive the fasteners.
- When possible, use clips attached with either anchors or screws. The end product will be more secure than when using nails. Drill the pilot hole using a sharp bit and minimum pressure to prevent breakage of the siding.
- When routing cable for a horizontal run, position the cable directly under the shingles where the upper and lower shingles overlap. This practice will effectively hide the cable run and provide for a professional look. Drive pin rings can be attached under the last row of shingles.
- Insert a drive ring into the bottom row of shingles, and drive the pin into a solid piece of wood.
- As with other fragile surfaces, do not over tighten the fasteners. This will help prevent chipping and cracking.

Sliding Clips

Vertical and horizontal siding clips are available for aluminum/vinyl siding cable attachments. The clips are designed to secure the cable to the siding without the use of the penetration-type fasteners (nails or screws).

Vertical Siding Clip

Horizontal Siding Clip

The installation process for attaching cable to aluminum siding is as follows:

- Each clip has a slot with which to attach the cable.
- Using the tapered edge of the clip, wedge the clip under the bottom of the siding panel where the panels overlap using hand pressure only. Do not hammer, screw, or staple the cable attachments into aluminum siding. The aluminum will be permanently damaged and will create an unattractive finish.
- Space the clips appropriately for all horizontal and vertical runs. Horizontal runs have better look than vertical ones.

Striking aluminum siding may cause permanent damage to the customer's property.

Vinyl Siding

Similar to aluminum siding, it is not recommended that holes be made in vinyl siding when attaching cable. In many cases, there is a void or empty space behind the vinyl panel. Some applications, however, do use some sort of polystyrene filler behind each panel. This type of vinyl siding is much more stable and will keep its original shape better than the former. Vinyl can become brittle when old or under extreme low temperature, so use caution when attaching the cable run. The technician may find that the siding has some spring to it when performing his/her cable run attachments. The installation process for attaching cable to vinyl siding is as follows:

- Using the same method of attachments as with aluminum siding for horizontal runs, position the vertical run clips 24 to 36 inches apart.
- If the customer approves beforehand, attach the cable under the corner molding of the siding for the vertical runs. As minimum, a siding clip should be used to firmly secure the cable at the top and the bottom of the vertical run. The cable can then be tucked under the corner molding. Be careful not to damage the corner molding when performing this task.

Stucco

While stucco is easy to penetrate and repairs are simple and economical, it is not the most secure surface to attach cable to. The outer surface is relatively thin and can crumble. In many cases, the material directly behind the stucco is polystyrene. This material is similar to flotation blocks used for boat docks and throw-away coolers. In some instances, the contractor has placed a thin plywood or particleboard sheathing over the polystyrene to allow for easier application of the stucco and to ensure a flat and square surface.

Drive pin rings are ideal attachment devices when installing multiple lines along the same run. An example is a customer who has several different cable entries to access outside rooms around the building. The cable service comes out from one location and may use at least a portion of a common cable run to its individual entry points. Drive pin rings can be used to attach these multiple lines in attics, under roof ledges, or basements and crawl spaces. Drive pin rings and C- shaped loops come in different sizes (for various amounts of multiple lines).

Drive Pin Ring

Drive pin rings can be driven directly into wooden beam, rafters, or trusses. The cable(s) are then pulled through the rings to support the run. Space drive pin rings at intervals that will reduce the amount of sag in the run. With multiple line runs, the more lines being used, the more they will sag. For multiple line runs, tie-wraps can be used to hold the bundle together in a neat fashion.

Do not over tighten the wraps and damage the cables.

It is always a good idea to discuss your cable run plan with the customer to ensure that he/she agrees with the route and where the run is attached. This is especially true in basements where the owner plans to finish an unfinished basement.

Drive Pins

Driving these pins into concrete is more difficult than other exterior surfaces. Care should be taken not to bend the fastener. It will take more force to drive this pin than in other applications. With this in mind, take careful aim when striking with the hammer so as not to damage the surrounding surface.

Flying particles can cause bodily harm. Always wear safety eyeglasses and the appropriate protective clothing.

Attaching these clips to concrete poses a more significant projectile hazard than other materials. Always wear eye protection to prevent injury from concrete chips and splinters.

Using a drive pin tool and hammer, drive the pin into the concrete until the ring of the pin is flush with the surface.

Bending Coaxial Cable

Exceeding the minimum bend radius can lead to cable damage and degraded signal quality.

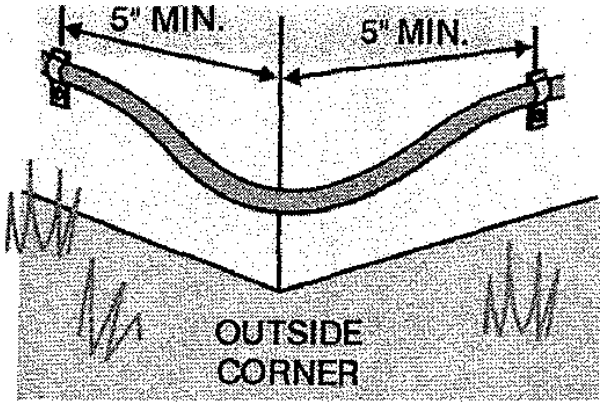
Throughout the entire cable installation process care must be taken when attaching, routing, and handling cable. Improper handling of the cable can result in cable damage and degraded signal. The following guidelines for bending cable apply for all cable installations including exterior/interior wiring:

- When bending cable for drip loops, around corners, and wherever a change in direction is required, always meet or exceed the minimum bend radius. The minimum bend radius of any application is 2½ inches. A 5-inch loop has a bend radius of 2½ inches. Whenever possible, strive for a 3-inch bend radius to ensure that no cable damage occurs.

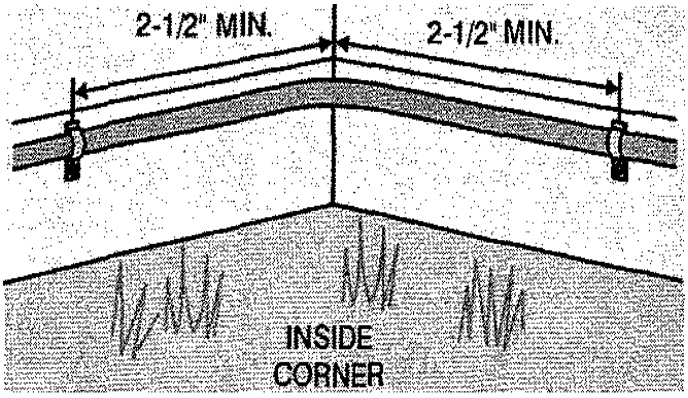
- For an average size hand, loosely wrap the cable around your fist; this will create a 6-inch diameter circle or 3-inch radius. If all the loops and bends are the same size throughout the job, a professional appearance will be achieved.

- For bending cable around a corner, place a closed fist between the apex of the corner and the inside edge of the cable to roughly determine the correct bend radius. Again, the average hand will acquire bend radius of 2½-3 inches.

- Attachment clips for outside corners should be places at least 5 inches from the apex of the corner on each side.



- Attachment clips for inside corners should be placed at least 2½ inches from the apex of the corner of each side.

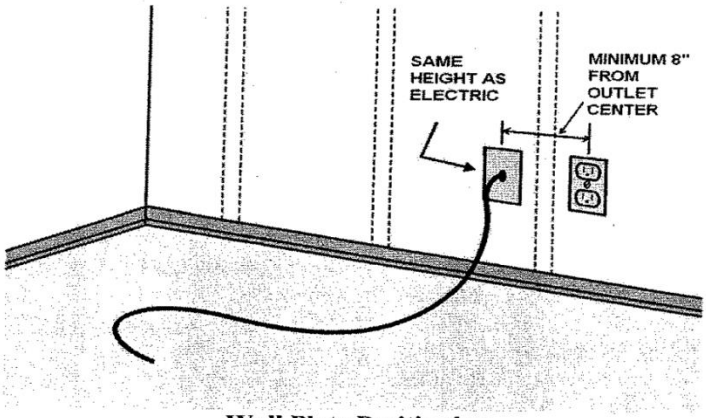


Cable Entry – Drilling

Once the plan for exterior and interior routing of the cable is established and the customer agrees with the method, cable entry can be attained. This section has described the methods for attaching the cable run(s) to the exterior of the building and now must be delivered inside the building.

This section will describe the techniques, tools, and precautions necessary to ultimately end up with the coaxial cable terminal end through the inside wall(s) of the building ready for interior wiring and routing. The following list describes the considerations and guidelines for determining the entry point(s):

- The entry point hole should always be drilled at the same height of any electrical outlets existing in the room(s). Ensure that an inspection of all entry point rooms is performed prior to drilling. Electrical outlet placement may differ slightly from room to room. Normally the builder will locate the outlets at the same height in all rooms. On occasion, the technician may encounter a room that has either been added on or refinished after initial construction. In these cases, the outlet location(s) may no longer be standard. This is especially true for finished basements and the lower level of both raised ranch and split- level homes.
- For standard platform and balloon frame construction, the entry hole should be drilled on either side of the electrical outlet. It is a good practice to place the entry hole on the opposite side of a wall stud on which the outlet has been mounted. Figure below shows wall plate positioning.



Wall Plate Positioning

Drilling through live electrical wires poses a severe threat of electrical shock. Always be sure of where you are drilling before starting.

- Electrical wiring usually runs vertically; and there is less chance of drilling through the wire. As stated earlier, mobile homes normally run the electrical wiring horizontally. Entry hole drilling for mobile homes should be performed either through the floor or above/below the electrical outlet.

- The entry hole should always be drilled at least 8 inches away from an electrical outlet.
- The entry hole should be located as close to the terminal connection (TV) as possible. In many instances, a technician will be called out to restore or reinstall cable at a previous customer's home after it is sold. The new owner may request the connection prior to establishing the final floor plan for furniture location. It is always a good idea for the technician to discuss with the customer where the TV will end up before drilling the entry hole.
- When establishing entry in an unfinished basement, drill the entry hole near (without damaging), other utilities.
- When drilling on an exterior wall where the cable must enter from the outside of the residence, angle the drill slightly so the hole on the outside is lower than the hole on the inside. This will help to prevent water from traveling on the cable into the house.

Safety Issues

- Always check the walls for objects (such as paintings, photographs, and decorative items) that may fall during the drilling process. This will help to prevent injury to the technician and prevent damaging the customer's possessions and property.
- Eye protection (safety glasses or goggles) is required whenever drilling operations are being performed.
- Ensure that drill bits are sharp before beginning entry-hole drilling. This reduces the chance of harm by flying objects (projectiles) and will also provide for a neater appearance.
- All drills are required to be of double-insulated design. Never modify the three-prong plug (such as removing the grounding prong) or extend the power cable by splicing in new wire. Always inspect the power cable and any extension cords for frays, cracks, splits, exposed wire, and repairs that used tape of any kind (even electrical tape). Never use a cable or extension cord that is found to be in this condition.
- Do not use the locking trigger feature of a drill if so equipped. It is always a safer practice to maintain positive control of the drill when in use.
- Do not apply excessive pressure when drilling. If it appears that excessive pressure is required to successfully drill the hole, stop drilling and investigate why excessive pressure is necessary. Things to look for include the following:
    - Dull drill bit
    - Drill bit slipping in chuck
    - Incorrect drill bit for the material to be drilled
    - Wrong rotation of drill bit
- If the drill is equipped with a "hammer-drill" setting, only use this setting when drilling through brick or cement.
- Ensure that there are no obstacles located on the exit side of the hole to be drilled.
- Select the correct type of drill bit for the material being drilled. Use a carbide-type drill bit for masonry/brick/cement/mortar and a high-speed machine-type bit for wood/metal/vinyl material.

High Speed Machinist's Bit

Masonry Bit

- The drill bit may become very hot once the drilling operation is complete. Never allow the drill bit to come in contact with material (carpet, draperies, etc) that could burn or melt under high temperatures.

Drilling the Entry Hole Through Walls

The following information lists the nominal procedure and guidelines for drilling entry holes through building walls. Thorough planning prior to actual drilling is always the best practice. Remember the saying, measure twice and cut once. It is more economical and ultimately quicker to do the job right the first time.

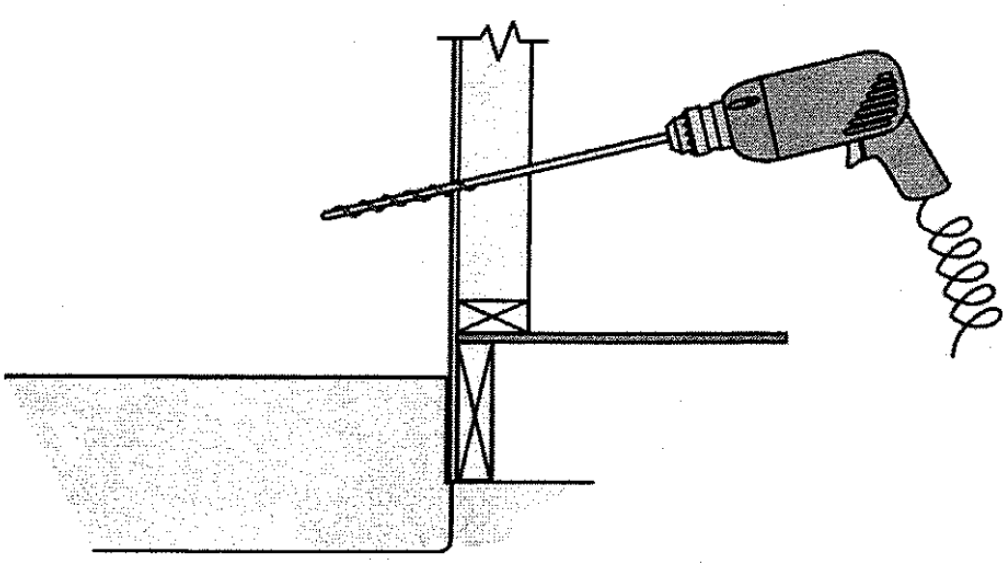
- Ensure that the exterior and interior materials that are to be drilled are correctly identified and that the proper tools are available to do the job.
- To ensure that the exit hole will be located where you expect it to be, find a common (to both exterior and interior) "landmark" by which to make measurements.
    - Inside comer of a door frame
    - Inside comer of a window frame
- Allow clearance for any slight measurement errors.
- For the sake of a professional appearance, attempt to drill the entry hole in a location that is not noticeable (i.e., the lowest portion of the wall).
- If drilling through a floor, always take care not to contact the carpet with a rotating drill bit.

Never drill directly into the carpet. A rotating drill bit can permanently damage the carpet by tearing fibers and even burning the material.

- Do not drill a wall where a “pocket door” travels through the wall cavity.
- Never drill through a roof.
- Avoid drilling through woodwork. This includes the following:
    - Molding
    - Window and door jambs
- Select the correct bit for the job (wood, masonry, etc.), and ensure that it is sharp.
- Make sure that the entire entry hole pathway is clear of obstructions:
    - Electric wiring
    - Plumbing
    - Telephone wires
    - Ventilation ductwork
- It is a good practice to drill from inside to outside.
- Once the drill has cleared the first wall (less resistance will be felt), stop the drill. Push the drill through the insulation until contact is made with the second wall (interior or exterior) and recommence drilling. This will prevent tearing up the

insulation between the walls and binding the drill bit as the insulation may wrap around the bit.

- With the drill stopped, move the bit around slightly between the walls to ensure that there are no unknown obstructions (plumbing, wiring, etc.). If some obstruction is detected, cut a hole on the interior wall at the entry/exit hole in order to allow for visual access to the space between the walls. The cutout hole should leave sufficient room for the wall plate to be mounted securely and be completely covered by the wall plate once installed. Use a flashlight to identify the obstruction. If an obstruction exists, the exit hole may have to be relocated.
- Ensure that the entry hole leading to the exterior of the building is at a slight down angle (from inside to outside). This will prevent water from seeping into the interior of the wall space. The exterior hole should always be slightly lower than the interior hole.



Drilling an Entrance Hole

Always ensure the safety of the customer as well as yourself during every drilling operation. Always be aware of where the drill bit will exit and what is on the other side.

- Ensure the safety of the customer (including children, pets, guests, etc.) during the drilling operation. Keep the area on both sides of the wall clear while drilling.
- It is also a good practice to use some form of "catch" material to collect drilling particles (newspaper, work rag, etc.). Make sure that the job site is clean after the work is done.

Cable Routing

Now that the entry hole has been drilled, the cable can be routed from the initial contact with the building to the interior of the building. The following lists the nominal procedure and guidelines for routing cable to the entry point and into the customer's building:

- For aerial drop installations, it is important that the technician try to route and attach the cable under the eaves from the house hook to a location where the cable can follow a straight (vertical) path to the ground block.

Straight lines (vertical and/or horizontal) create a more professional appearance than diagonal lines.

- Make every attempt not to place exterior wiring on the side of the building facing the street. If you must route cable on the front side of the building, ensure that it is concealed as best as possible. It is policy to gain the customer's permission prior to routing. Some ideal places to hide cable routes are as follows:
  - Behind downspouts
  - Under ledges and overhangs
  - Behind shrubs, flowers, facades
  - Along the edges or seams of exterior siding
- Always square off the cable run to the shape of the house. This will provide for a less distracting appearance.
- Adhere to spacing guidelines of 16 to 24 inches for horizontal runs and 24 to 36 inches for vertical runs when attaching clips to the building. Make sure that cable is straight (not sagging) in the clips.
- Adhere to the minimum bend radius guidelines (2 inches) for Series-6 cable.

Weatherproofing the Entry Hole

In order to prevent water damage to the customer's building due to cable entry, weatherproofing the entry hole is a must. Water damage to the building can be extremely expensive and may leave Connect/One liable for the repair. Additionally, the cable and its connectors need protection from water damage. While this damage will not directly affect the building, it can create poor signal quality.

RTV Silicone

RTV silicone compound, *shown below*, is recommended method of waterproofing the entry hole.

Avoid contact with skin. RTV silicone uses acetic acid for curling. Ensure that all safety precautions on the container are followed and that you are familiar with the applicable Material Safety Data Sheet (MSDS).

RTV Silicone Compound (Entry Hole)

Guidelines for this method of waterproofing are as follows:

- Ensure that the entry hole is completely cleaned out. Loose material left in the hole from drilling operations will cause a poor sealing of the entry hole and may allow water to enter in the future.
- Ensure that a bushing, if applicable, is properly placed on the cable (the smaller end pointing in the same direction as the end of the cable). Then insert the cable through the center of the entry hole. Make sure that enough cable is inserted to allow for all the cable length needed to complete the wall plate installation (always leave more cable than expected). Once the necessary cable length has been pulled through the bushing, apply RTV into the entry hole around the cable.
- Fully insert the cable and bushing into the entry hole. If an excessive amount of RTV is present, it can be cleaned up with a shop rag. Make sure that after the RTV is wiped up, there is still a visible and continuous bead of sealant remaining around the edges of the cable.

Installing an Amplifier

Sometimes the end signal to the customer's terminal equipment does not meet the minimum dB requirements. When the drop signal strength is within the minimum strength requirement but the terminal signal strength is still too low, an amplifier might be needed to boost the signal. The technician must realize that the decision to install an amplifier is not made lightly and that all other options to provide minimum strength have been explored. Amplifiers are costly to the customer and can create more problems in cable service than they resolve. In all cases, the technician must ensure that accurate and comprehensive troubleshooting of the degraded signal strength is performed before installing an amplifier.

In-House Amplifier

In some cases, accumulated forward signal loss (usually created by numerous cable splits, very long cable runs, traps, exceeds the capability of the tap signal level. In this case, an amplifier can be considered to sufficiently boost terminal equipment signal strength to satisfy minimum level requirements. Never use an amplifier to overcome network or drop faults in signal level.

These amplifiers come in the 10 dB, 15 dB and 20 dB output ratings. Amplifiers are normally powered by 110 VAC home electrical outlets. The following general guidelines are for locating and installing in-house amplifiers:

- Amplifiers must be mounted inside the house (basement, attic, or crawl space).
- Amplifiers cannot be effectively weatherproofed.
- Amplifiers must remain accessible. It is a good practice to mount the amplifier near other existing utilities.
- Amplifiers must be mounted in close proximity to an unswitched electrical outlet (within the reach of the provided power cable).
- The installation of an amplifier must be documented on the service order.

- When installing an amplifier in a line using the online service, install the amplifier "downstream" of the splitter using a separate line for video. (The introduction of an amplifier on the same line as the PC creates a lot of return signal noise.)
- Always obtain customer permission before installing an amplifier. (Amplifier installation can increase significantly the overall installation cost to the customer.)
- The last step in amplifier installation should always be plugging it into the power source.
- Always perform a signal leakage test once the amplifier installation is complete.

Interior Wiring

This section provides information on routing the video cable once it has been directed inside the building. The section describes the following:

- Guidelines for interior cable installation
- Relocating cable installations
- Routing interior cable lines

Guidelines for Interior Cable Installation

It cannot be stressed enough how important planning the installation is for successful and professional interior wiring. Once a plan has been developed, ensure that following steps have been completed before actually starting the installation:

- Review the work order with the customer.
- Even if the terminal equipment is already placed in the room, confirm its final location with the customer prior to installation. This will prevent frustration later on both sides and ensure customer satisfaction. Have the customer turn on the terminal equipment at each video cable connection to ensure that all the equipment works. This will prevent Connect/One from possible liability should the customer declare later that the technician damaged the equipment when, in actuality, it was already damaged.
- Outline the routing path from each connection to the grounding block. The straightest path will not necessarily be the best path.
- Run one complete drop for each set while using only one splitter, located near the ground block.
- Once the route has been determined, discuss the pathway with the customer and identify where all holes are to be drilled. Always attain customer agreement for the work.
- If the customer has some objection to the proposed routing, solicit ideas from the customer on optional paths and the reasons why the customer prefers them. If the suggestions offered are not possible or practical, or at any time endangers people or property, explain why. There is never a cause to argue; always apply the reasoning towards the customer's best interest.

Relocating Cable Installations

Relocating means that an existing cable needs to be moved from the present location to a new one; there are several reasons for a relocate. The most common reason is that a new customer now resides in the building or apartment and desires to place his/her terminal equipment in a different location from the previous occupant. In most cases, the procedure for relocates is as follows:

- Drill a new hole.
- Route the cable to the new location directly from the grounding block or splitter.
- Never splice into an existing cable. This may lead to loss of signal quality.
- Existing wiring can be used as long as it is in good working condition.

Routing Interior Cable Lines

The methods for routing cable through the interior of the building can be fairly consistent for a variety of construction styles. The most common methods of routing the cable directly to the customer's terminal equipment are as follows:

- Direct entry to the installed wall plate
- Entering the basement/crawl space or attic
- Through the floor, ceiling, or use of interior wall space by "fishing" the cable.

Direct Entry to the Installed Wall Plate

For installation directly to the wall plate, the cable is run from the grounding block to the point on the outside wall directly on the other side of where the customer's terminal equipment will be located. The entry hole will be drilled through the outside wall and attached to a wall plate on the inside wall.

Wall plates are commonly mounted in two ways. The first method incorporates the use of an F-81 connector or barrel splice on the wall plate to which the cable drop is connected. The second method runs the drop through the hole in the wall plate without an F-81. The use of the F-81 lends a more professional appearance but costs more to install than the second method. As stated earlier, whenever a cable splice is made, the opportunity for degraded signal quality exists.

Mounting a Wall Plate Using an F-81 Connector

The first step in mounting the wall plate consists of holding the wall plate up against the interior wall where it is to be mounted (centered over the entry hole). Ensure that the wall plate is located at least 8 inches to either side of an electrical outlet and is at the same height as the electrical outlets in that room.

Wall Plate with F-81 Connector

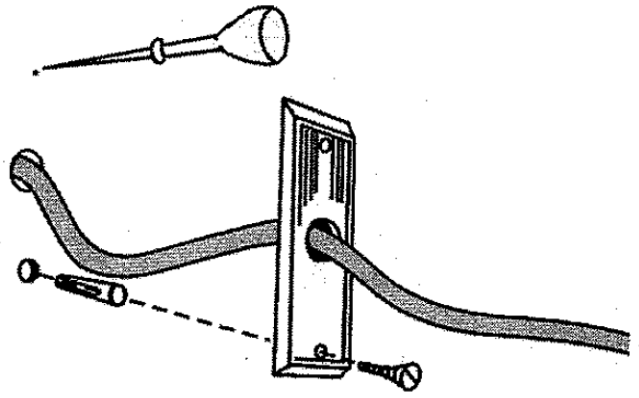
- Once the wall plate is positioned where it is to be installed, mark the wall using through mounting holes on the wall plate.

- Install an F-connector on the exterior cable and connect the cable to the F-81 installed in the wall plate. Always leave some excess cable (no more than 6 inches). Place the excess cable inside the wall space. Ensure that cable is located sufficiently away from any existing phone or electrical line and any heat generating objects (plumbing, ductwork). Install the wall plate onto the interior wall. Do not create kinks in the cable; always adhere to the minimum bend radius guidelines (2-1/2 inches).
- Using the marks made on the interior wall through the wall plate, drill or punch (using an awl) the holes for the wall plate fasteners. It is advised that anchors be used especially when attaching wall plates to drywall. Drywall does not accept screws very well as the material is fragile and tends to crumble under pressure.
- Do not over tighten the screws. This may cause the wall plate to distort or even crack.
- Make a jumper cable of approximately 6 to 8 feet for attachment to the customer's terminal equipment. Always leave enough cable running from the wall plate to the terminal equipment to allow for minor moving. This will allow the customer to make slight changes in equipment location and provide enough cable slack to enable the customer to clean behind the equipment or install new equipment.
- Secure the jumper to the wall plate hand tight. Do not use a wrench to tighten fittings on any customer terminal equipment.

Mounting a Wall Plate without Using an F-81 Connector

If the interior installation is to be performed without using an F-81Connector follow these steps:

- Mount the wall plate using the same method as discussed in the F-81 section on the previous page.



Mounting a Wall Plate (F-81 Not Shown)

- Determine how much cable will be required to easily reach the customer's terminal equipment and add 2 feet for future movement.
- Ensure that no cable splices exist between the grounding block and no splitters are installed going to the terminal equipment.

Drilling Through Furniture or Cabinets

Never drill through the customer's furniture or cabinets.

If the customer requests that holes be drilled in these items for cable routing, politely decline and explain that it is against company policy. Always attempt to provide another alternative to this practice. If the customer insists, explain that the work will have to be done by the customer or a contractor that the customer must hire.

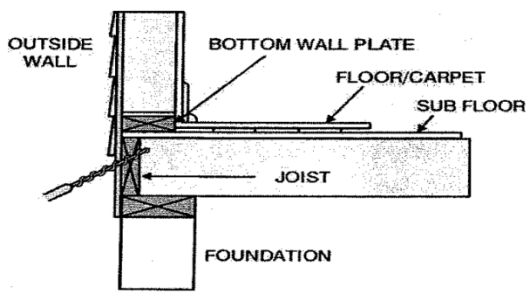
Routing Cable Through a Basement/Crawl Space

This method of interior cable routing consists of running an individual drop from the grounding block into the basement/crawl space. The cable is then routed up through the interior wall space to the customer's terminal equipment.

Drops can also be routed into the basement/crawl space through the space and back out to the other side of the building to access another terminal equipment location. This method is preferred over extensive outside routing of cable. The less cable routed outside the building, the more professional the appearance. This may not be practical in all cases. The following information discusses the general guidelines for routing cable through basements and crawl spaces:

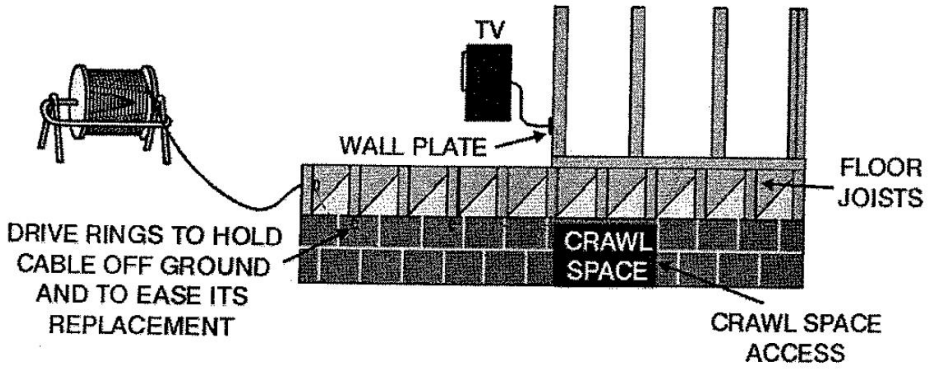
Depending on the geographical area, many dangerous insects, rodents, snakes, and hazardous pesticides may be found in a crawl space. For the Northeast region, these can include copperhead snakes, rattlesnakes, brown recluse spiders, ticks carrying Lyme disease and rabid mammals.

- Inspect the work area as much as practical before entering; this especially true for crawl spaces. Look for obvious signs of potentially dangerous inhabitants (rodents, snakes, spiders, etc.). Some obvious signs are droppings, nests, and webs.
- Once the entry hole has been determined, ensure that no obstructions exist inside the space.
- Drill directly through the header joist.



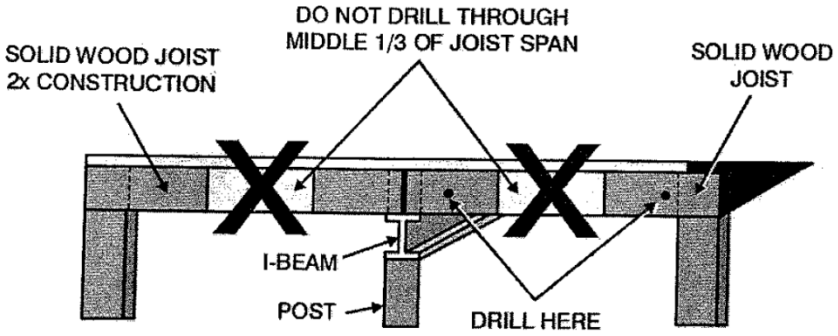
Drilling Header Joist

- Once access has been made to the space, attach a drive ring onto every other floor joist to support the cable run.



Routing Cable Through Crawl Space

- As mentioned previously, if you are routing through an unfinished basement, check with the customer to determine if there are any intentions of finishing the space in the future. This may influence the intended route and must be considered before cable attachment.
- When drilling through the floor joists, locate the holes on the outer third of the joist span between supports.



Drilling Holes in Floor Joists

Drilling through the center 1/3 of the span may weaken the joist.

- It is a good practice to run the cable either at right angles to beams or in line with the beams. This leaves a much better appearance. Always maintain the minimum bend radius guidelines when routing the cable.

Never attach or allow the cable to come in contact with hot water pipes, gas/oil lines, AC lines and electrical service lines or interfere with any other building services and utilities.

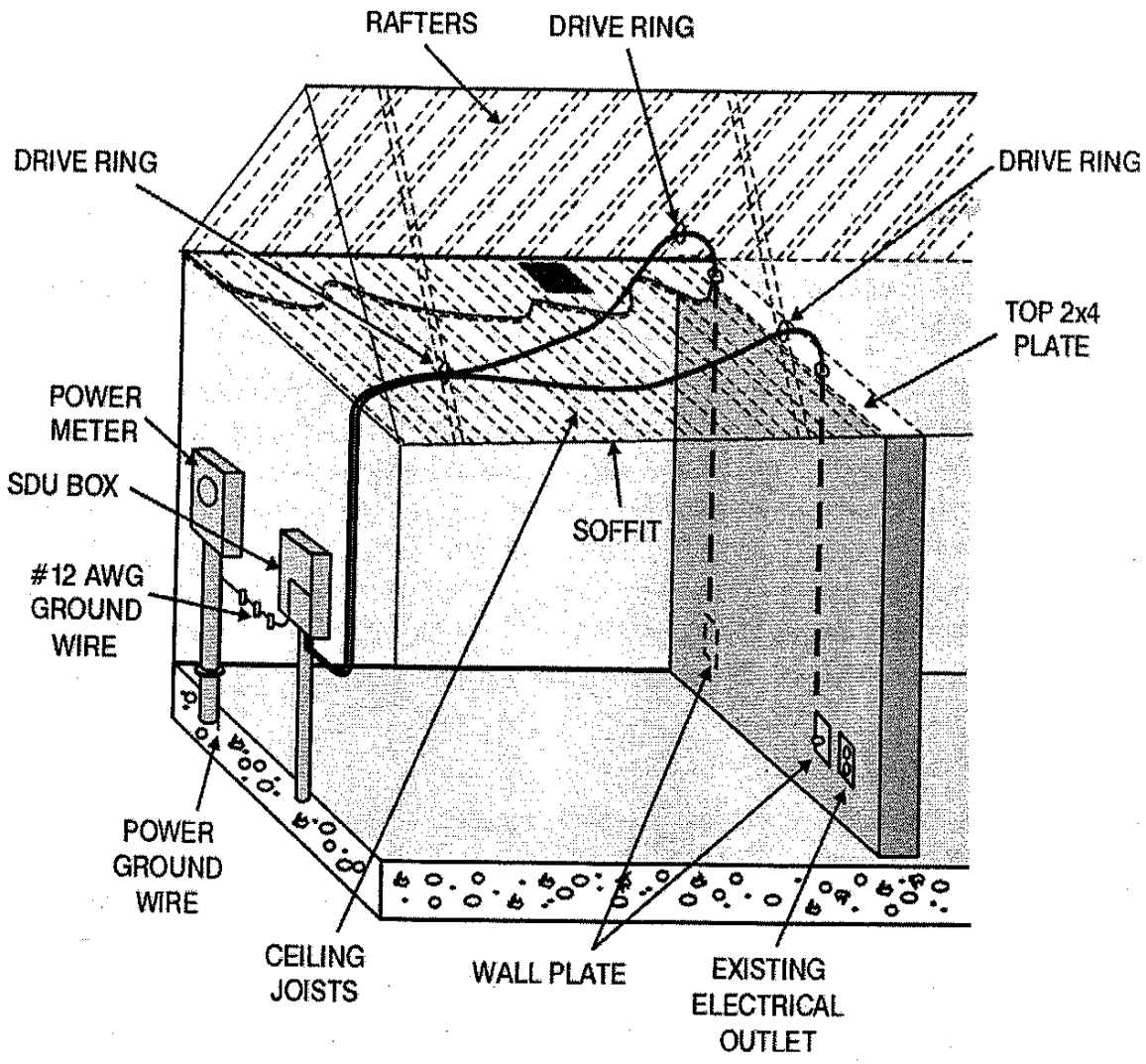
If it is required that a splitter be installed in an unfinished basement, locate the splitter where it will be easily accessible in the future. Inform the customer of where the splitter is to be located, just in case the customer decides to finish the basement in the future. If the customer decides to finish the basement, request that the customer contact Connect/One prior to finishing so that the splitter can be relocated as necessary. Note that this will require an additional service charge.

Routing Cable Through an Attic

Another common entry and routing path for cable is through the attic space. In most cases, these spaces have little to no services running through them and provide less obstruction for routing. However, some portions of central air conditioning systems may be located in the attic space. Ensure that the cable routing does not damage or interfere with this equipment. The following are some general guidelines for routing cable through an attic space:

Be alert for spiders, wasps and high temperature hazards. If the attic space contains loose insulation, wear protective clothing and a breathing apparatus to prevent contact with the insulating material.

- Use deliberate care when choosing your footing when in the attic space. Chances are good that if there are no visible floorboards in the attic space, the space between the ceiling joists is just dry wall or lattice-type ceiling plaster. Test the flex in the ceiling joists to determine whether the joists will support your weight. Extensive flexing of the ceiling joists may cause the dry wall or plaster to bow and crack. This can lead to rather expensive repairs.
- The ideal entry point into the attic is through the soffit. The soffit is located under the eaves (or overhang) of the roof. The second choice for entry is directly through the attic wall. In either case, ensure that the entry hole is sufficiently waterproofed. Run the cable as close to the outer edges of the attic as practical. Cable attachments can be made either directly to the ceiling joists for attics without floors or directly to the rafters for attics with floors (this will prevent trip hazards or inadvertent damage to the cable from the foot traffic).
- The cable is then routed to the point(s) where the internal wall space is to be sued to provide access to the wall plate.



Routing Cable Through Attic

Fishing Cable Through Enclosed Spaces

Fishing cable through interior wall or ceiling spaces is not part of a standard installation. Fishing cable can be time consuming and requires the utmost planning and understanding of the construction of the building being worked on. The customer is responsible if they want a "custom install", they can hire a contractor or do it themselves.

Routing Cable Inside a Room

It is always a good practice to hide as much cable as possible. This practice will leave the best impression on the customer and create a totally professional appearance. The two most preferred places to plan the cable route are through the basement/crawl space and through a drop-type ceiling.

In some cases (as homes built on slabs, homes with finished basements and some raised-ranches), access is not available below the first floor of the building. In these cases, cable may have to be routed around the inside of the room after initial entry from the outside has been made. Plan your route carefully, and avoid running cable all over the room. Determine the closest point to the terminal equipment that can be accessed from the outside and plan on the route from that point.

- Consider running the cable attached to the bottom portion of the baseboard. Ensure that the cable is secure around the whole route to prevent a tripping hazard in the future.

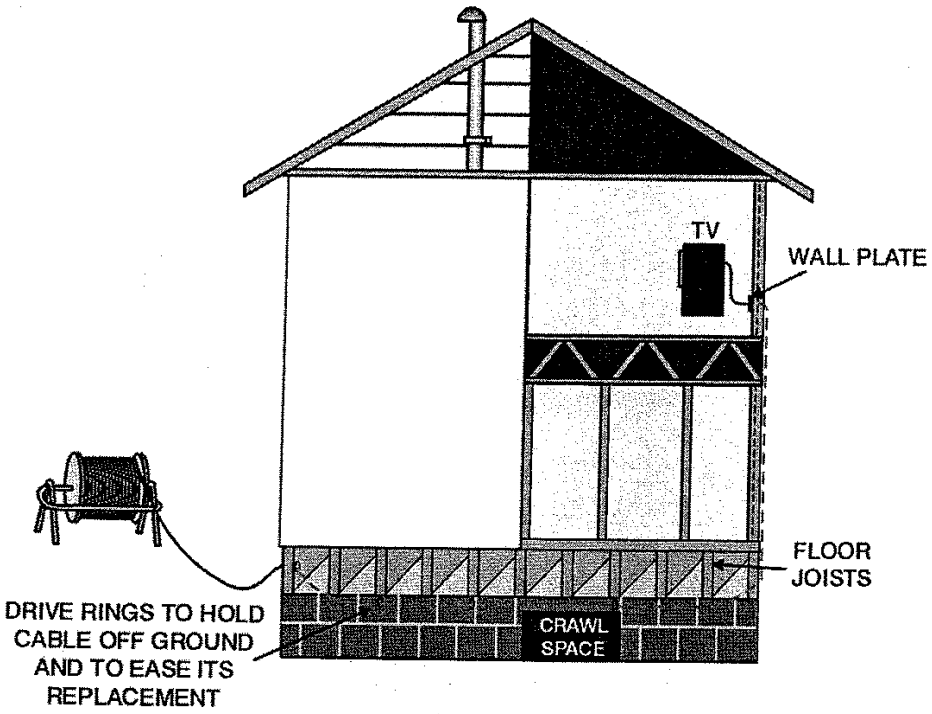
Never cross a doorway with the cable, not even under a rug. The cable will create a tripping hazard. Excessive traffic will eventually damage the cable. The crushing of the carpet on top of the cable will also mar the surface of the carpet and wear out the pile or weave.

- In many cases, newer homes with baseboards have some space between the bottom of the baseboard and the area where the carpet is attached; this can be an ideal place to route the cable. In newer carpet applications, the carpet is attached to the floor using thin strips of wood (tack strip) with carpet nails pointing upward. These strips are nailed to the sub floor, and the carpet is pressed on top of the extruding nails. There may be a small space between the outer edge of the carpet strips and the wall, directly below the baseboard. Care must be taken when inserting the cable into this space. The extruding nails are extremely sharp and could damage the cable during installation.

Routing Cable to the Upper Floor

Cable in the second floor of a building is usually routed on the outside of the building up to the second-floor wall. Sometimes it may be necessary or desired to run the cable through the attic and then into a second-floor closet located near the ultimate terminal connection point. Use the following general guidelines when routing cable to a second or third floor:

- As with all other cable routing operations, careful planning is a must. If it is possible, run the cable through the attic, into a closet, and out the closet wall to where the terminal equipment is located.
- When drilling the hole in a closet, choose a corner to drill the hole up into the attic. Ensure that the exit hole and drill will be free of obstructions in the attic space.
- Always get the customer's permission prior to drilling from the closet through a second floor wall.

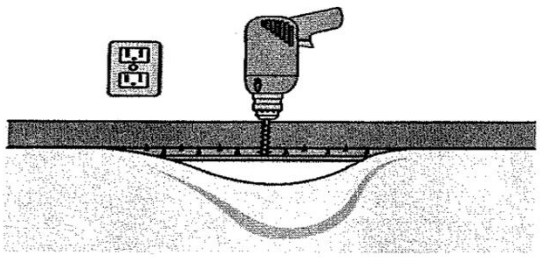


Routing Through Crawl Space to Second Floor

Routing Cable Through a Carpet

If the cable must be run up through a carpeted floor, make sure that the customer is notified, understands the reason, and gives permission prior to drilling. The hole should be located as near to the wall or baseboard as possible. If the carpet can be pulled away from the wall, follow these guidelines:

- Gently pull up the carpet directly over the proposed hole location. Only pull up the bare minimum (4 to 6 inches) of carpet to expose the floor beneath.
- Drill the access hole between the wall (or baseboard) and the carpet tack strip.
- Feed the cable through the hole in the floor and the carpet. Reattach the carpet to the tack strip. Ensure that the carpet is completely attached and flat on the floor.
- If the carpet cannot be pulled away from the wall then the cable cannot be run through the carpet. Do not drill through a carpet.
- Do not allow the drill bit to come into contact with the carpet while operating the drill.



Drilling Through a Carpeted Floor