LEVITON®

Basic Residential Installation Guide

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Introduction

More than ever, today's homeowners are confronted with an expanded range of technologies and choices — with some hard decisions as a result. The three standard television channels of the 1950's and 60's, for example, have exploded into hundreds of digital cable and satellite choices. With Ethernet quickly replacing traditional satellite and cable options, video on demand and streaming video have given us the ability to watch almost anything at any time. Additionally, the quality of the incoming audio/video signal has evolved to the point where the luxury of a home theater is increasingly considered a standard feature.

On top of all these new incoming home technologies, age-old needs such as security, convenience, and comfort are raising homeowner expectations in every area. Smarter lighting, better power quality, tracking energy efficiency, and comprehensive smart home control are just some of the applications making the leap from luxury to everyday use.

For more than 100 years, the name Leviton has been synonymous with quality in connectivity. From multimedia panels to surge-protected AC outlets, from three-way lighting to Cat 6 and Cat 6A cabling, Leviton's highest level of products, skills, and resources are combined to provide solutions ideal for today's applications and tomorrow's challenges.

1. Important Safety and Installation Information
For All Telecommunications Applications

There are special safety considerations with telephone wiring that may be unknown by workers new to this field. The following guidelines should be followed closely to help avoid safety hazards, and ensure trouble-free installations and high-quality telephone service.

This publication cannot, however, cover every aspect of safe installation and connection of communications wiring. The installer must follow local code requirements, including those established in applicable chapters of the National Electrical Code, and all rules or suggestions of the local Service Provider and/or governmental and other regulatory agencies.

High-Voltage Safety Test:

Experienced electrician's, at first contact, always assume that hazardous voltages may exist in any wiring system.

A safety check, using a known, reliable voltage measurement or detection device, should be made immediately before work is started and whenever work is resumed on any job.

Heart Pacemakers:

Never attempt repair, installation, or modification of telephone equipment or wiring systems if you wear a pacemaker. Pacemakers can be disrupted by telephone-circuit voltages and ringing-cycle frequencies.

Lightning and High-Voltage Danger:

Most electrical injuries involving communications wiring result from sudden, unexpected high voltages on normally low-voltage wiring. Installers may relax their normal care when handling communications wire because it is a low-voltage system. However, communications wiring can carry hazardous high voltages under certain unsafe conditions. Never install or connect communications wiring during electrical storms. Improperly protected communications wiring can carry a fatal lightning surge for many miles. Lightning exposure can also be a danger to telephone users. Therefore, jacks should never be installed in a position that would allow communications use by a person while in a bathtub, hot tub, or swimming pool. All outside wiring must be equipped with properly grounded and listed signal circuit protectors. These protectors must be installed in compliance with the requirements of the local service provider and applicable codes. Do not remove or modify protectors or the grounding wire placed by the service provider. Connections to service provider independent grounding systems can be made only with the approval of the local service provider. Do not run open wiring between structures where it may be exposed to lightning without proper protection. Avoid wiring in or near damp locations.

Wire Separations:

Communications wiring systems must be installed to minimize the possibility of accidental contact with hazardous power and lighting wiring. Never place communications wiring near bare power wires or lightning rods, antennas, transformers, steam or hot water pipes, or heating ducts. Never place communications wire in any conduit, box, channel, duct, or other enclosure containing power or lighting circuits of any type. Always provide adequate separation of telephone wiring and other electrical wiring according to code. When in doubt about separation distances, the “Rule of Sixes” can be used. This rule suggests six feet of separation between communications wiring and open, high-voltage wiring, lightning grounding wire, or grounding rods. It suggests six inches of separation from all other high-voltage wiring unless in conduit.

Avoiding Shocks — Plain Old Telephone Service (POTS):

Fifty (50) to sixty (60) volts DC is normally present on an idle tip-and-ring pair. Ninety (90) volt AC ringing current can deliver an uncomfortable shock under certain circumstances. Consequently, always use insulated tools and avoid all contact with bare terminals and grounded surfaces.

To avoid being shocked, always disconnect the dial-tone service from the premise wiring while working. If you cannot disconnect, take the telephone handset (receiver) off hook. The DC level will drop and normally no AC ringing current will be delivered (be sure to replace the handset when work is completed).

Metallic Surfaces: Special caution is required when running communications wire on or near metallic siding. Always check for stray voltages present on any metallic surfaces.

Cutting and Drilling: Always observe trade safety rules for concealed wiring. Be extremely careful not to cut through or drill into concealed wiring or pipes. Make a small inspection opening before cutting or drilling.

Splicing: Common wire-splicing techniques may cause the wire to break and result in poor circuit integrity. This can cause interference in the form of static and noise on the line.

Clean Contacts: Dust or dirt can cause special problems on communications wiring contacts. Be sure all contacts are clean and that all parts are installed correctly to protect them from dust and dirt.

Local Ordinances, Covenants, and Service Provider Coordination

2.1 Local Ordinances

Local ordinances require adherence to national and local electrical codes when installing AC and, in many instances, low-voltage wiring and devices. Make sure you follow all local ordinances and codes according to the local Authority Having Jurisdiction (AHJ) when installing a Leviton Connected Home system. For example, this manual refers to the use of mud rings instead of electrical boxes for low-voltage wallplate locations. Your local area may require electrical boxes and conduit for all low-voltage wiring. In these cases, be sure to substitute the appropriate type and size of outlet boxes and conduit to comply with local ordinances. Remember to use boxes and conduit of sufficient size to accommodate and meet the cable pull, cable fill, and cable service loop requirements listed in Chapters 6 and 7 of this Installation Manual.

2.2 Covenants and Builder Considerations

Your local community may have certain covenants that specify location of service entrance and/or demarcation points for CATV, telephone, and other communications services. External jacks and TV antenna outlets also may be restricted. External satellite antenna, TV antenna, and outdoor speaker locations may be restricted, prohibited, or limited to certain locations in your area.

In addition to local covenants, your builder may have design requirements specifying the location of central wiring locations (the location of the Leviton STRUCTURED MEDIA™ enclosure within the home). Also, the builder may specify the number and location of various wallplates, telephone, data communications, and Cable Television (CATV), or Digital Satellite Service (DSS) jacks.

Be sure to check that your plans meet all local covenants and builder specifications during the planning and installation of Leviton Connected Home systems.

2.3 Service Provider Coordination

The telephone, CATV, and other communications service providers serving your site may have special requirements and services that you should know about prior to planning and installing Leviton Connected Home systems.

Be sure to check the availability of local Cable, Fiber, DSL, or other network services from local service providers and municipalities. Availability of these services will dictate the number and type of cables installed from the demarcation point to the STRUCTURED MEDIA enclosure, the type of components in the enclosure, and certain wallplate configurations within the home. Your builder may specify certain Leviton Connected Home products based on the availability of these services.

Alarm security services may also have a service demarcation point, separate from other service provider connections. Please check with the designated security services provider if any such services will be offered.

CATV may or may not be offered in your building area. If not available immediately, CATV service is often added at a future date and the wiring plan should provide for CATV service from a demarcation point into the house.

Please check with the CATV provider to determine the number of service entrance cables you will need. In some communities, two or more cables may be required to offer alternative CATV services, or to provide an increased number of cable channels. You must duplicate the number of required cables from the CATV demarcation point to the SMC and to the CATV jacks in the home. Typically, the CATV provider will provide a signal level of 0 dBmV to 15 dBmV. The signal level at the demarcation point will dictate whether a signal amplifier is required prior to coaxial splitters.

A TV antenna and/or Digital Satellite Service (DSS) provision for distribution throughout the home from the SMC is not just an alternative to CATV. Your planning and installation should include provisions for DSS even when CATV is available. Many homeowners want either an alternative to CATV, or both CATV and DSS services. The DSS dish may require one or two RG-6 quad-shielded coax cables to the SMC, and from there to DSS receiver locations. Most RG-6 quad-shield cables for video and TV distribution within the home use a copper-clad steel core to provide optimum video signal performance and cable strength. However, for the coax cable that connects the satellite dish to the satellite receiver, many DSS manufacturers recommend solid copper-core RG-6 quad shield because the cable must carry power (voltage switching) to switch LNBs (Low Noise Block downconverters) at the dish. Make sure you understand the requirements for the installation. An Over-The-Air (OTA) TV antenna may require one or two cables to the SMC, and from there to TV locations. When planning external antennae or satellite dishes, make sure to take all necessary grounding, mounting, and lightning protection precautions that may be required in your region.

3. System Overview

STRUCTURED MEDIA™

STRUCTURED MEDIA refers to a system that supports the range of information, communication, and entertainment technologies available to the modern home—including telephone, Broadband Internet, cable and satellite TV, and more. Leviton's STRUCTURED MEDIA System takes the concept of structured cabling, as practiced in demanding commercial applications for business and office networking, and combines it with multimedia to accommodate the convergence of Broadband Internet, Cable and Satellite TV Services, Wi-Fi®, and the many devices and applications such services enable including home internet connectivity, television, telephone, IoT (Internet of Things), Smart Home, Home Automation solutions, and more.

Most important, Leviton's STRUCTURED MEDIA program gives end users a standards-compliant system — an important consideration today where inadequate or substandard performance may mean a lot more than a call-back. Each properly installed Leviton STRUCTURED MEDIA System is designed to meet ANSI/TIA-570-D, the most stringent residential standard.

4. Description

The Leviton Connected Home STRUCTURED MEDIA™ System

Leviton Connected Home Systems are composed of a series of smaller subsystems. The STRUCTURED MEDIA system covers all of your communications and entertainment needs. This system or infrastructure includes the following:

- A STRUCTURED MEDIA enclosure or centralized distribution panel
- Modules for data, telephone, video, and entertainment end-use devices
- Stylish wallplates with snap-in connectors at the points of termination
- Flexibility to support current and future applications through the addition or upgrade of system components

4.1 STRUCTURED MEDIA Enclosures

The STRUCTURED MEDIA Center is a consolidation panel for low-voltage wiring. All your points of origination are neatly and safely contained in one protected box. Leviton offers the following STRUCTURED MEDIA enclosures:

Wireless SMCs (ABS Polymer Construction)

- WSMC 14" Enclosure
- WSMC 28" Enclosure
- WSMC 42" Enclosure

Metal SMCs (Steel Construction)

- SMC 14" Enclosure
- SMC 21" Enclosure
- SMC 28" Enclosure
- SMC 42" Enclosure

It is important to size the STRUCTURED MEDIA enclosure accurately to your job specifications. Several factors will influence the complexity of your structured cabling installations including:

- The size of the dwelling
- The requirements of the customer
- Project budget

Installer Tip:
The future will be filled with more internet connected appliances and devices, not fewer. Keep expansion in mind when you discuss the system installation.

Available in three sized, Wireless STRUCTURED MEDIA centers support a wide range of building types and floor plans. The enclosures use ABS polymer construction to permit the full reach of a wireless network, as opposed to standard metal enclosures.

The Wireless STRUCTURED MEDIA Centers include a Ratcheting Hinge and Latch System for tool-free door installations. The ratcheting feature accommodates for drywall imperfections and varying thickness of drywall.

4.1.1 14" and 21" STRUCTURED MEDIA Enclosures

14" and 21" enclosures are professional-grade, whole-house media enclosures well suited for a condo or typically sized detached home. Each can accommodate two Pre-Configured Structured Cabling Panels or an assortment of both full- and half-width expansion modules. Two or more 14" enclosures can be combined for larger installations, or you could use the 21" model for similar applications.

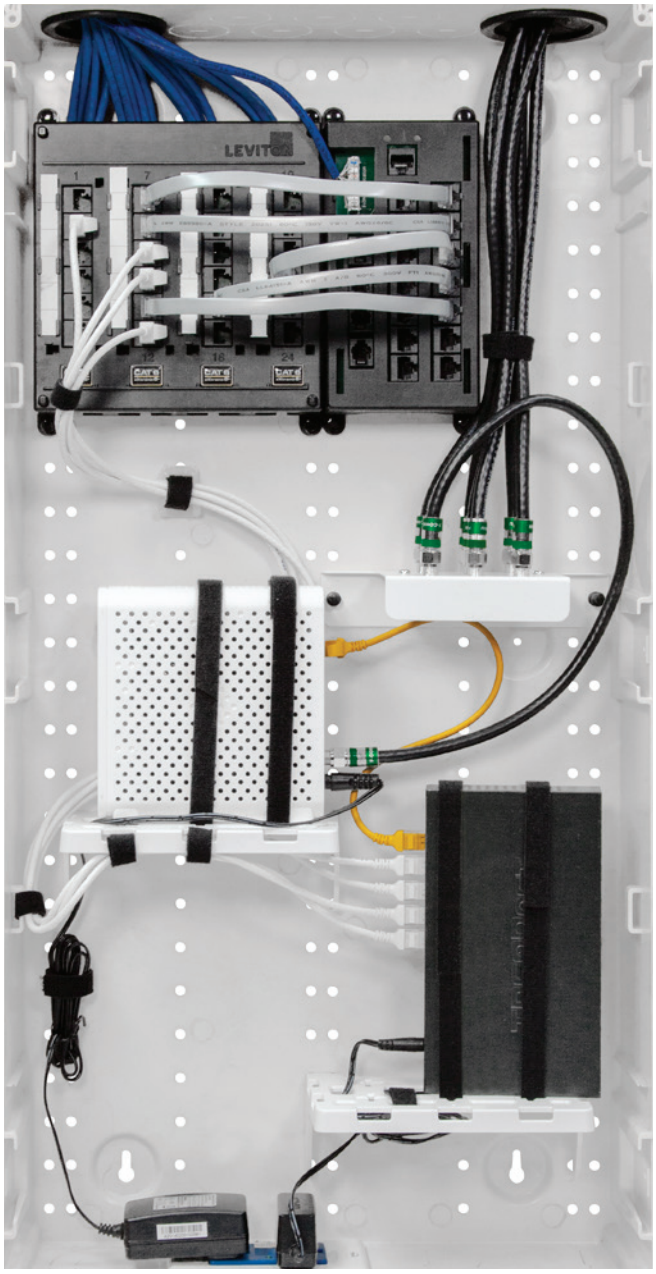
Details

- Enclosures with covers are sold separately or as a kit or individually as well as in job/bulk packs
- The SMC is suitable for new construction and retrofits and can be surface mounted or recessed between wall studs
- SMCs are constructed with white powder-coated steel. WSMCs are molded from a UL 94V0 rated ABS Polymer. Covers, doors, and trim accessories feature a 3/4-inch overlap to hide irregular drywall cuts

A 14" SMC enclosure will typically serve a two-bedroom condominium, apartment, or townhouse.

4.1.2 28" and 42" STRUCTURED MEDIA™ Enclosures

The 28" enclosure is designed for expanded installations. Using the 28" enclosure in an infrastructure installation ensures “room to grow.” Remember, the main difference among the enclosures is the size of the enclosure and AC power options. The 28-inch length provides abundant room for up to eight individual distribution modules (sizes and density of the modules will vary). This means you can use a single distribution center for all the latest technology such as home networking, security cameras, and multi-room audio. The enclosure's top and bottom panels feature multiple knock-outs throughout for ease of cable routing.



The 28" enclosure is designed to accommodate Leviton AC Power Modules, available with or without Surge Protection. Surge protection modules provide protection for all connected active equipment.

Details

- Large capacity can service more intricately wired homes
- Accommodates quarter, compact, and standard expansion modules, with both horizontal and vertical placement for most modules
- Enclosures are available in powder coated steel or ABS polymer construction. Covers and doors feature a ¾-inch overlap to hide irregular drywall openings

For a three-bedroom, single-family home with a 28" enclosure, Leviton suggests the following components to meet most homeowners’ basic structured cable needs:

- AC Power Module
- Basic Home Networking Plus Unit consisting of Telephone Patching Expansion Module, Cat 5e Voice/Data Module, and 1x6 Video Splitter

The 42" enclosure is Leviton’s largest enclosure. It can accommodate several panels and modules, allowing it to manage many high-tech functions simultaneously. Its dimensions and details are similar to the 28" enclosure, except for its greater length.

The 28" and 42" STRUCTURED MEDIA enclosures can accommodate a varying array of individual distribution modules from Leviton’s Connected Home STRUCTURED MEDIA line including:

- Premium Splitters, P/N 47693-08P, and 16P for Cable Distribution
- Passive 1x6 and 1x8 Video Splitters, P/Ns (2 GHz) 47690-6C2, 47690-8C2
- Twist and Mount Patch Panels
- Pre-configured Standard and Compact STRUCTURED MEDIA Panels
- Device mounting brackets and shelves for active gear

A Large Home Configuration for a four-bedroom home would include the following components in a 42" enclosure:

- AC Power Module, P/N 47605-DP
- Telephone Input Distribution Panel, P/N 476TL-T12
- 12-Port Cat 6 Twist and Mount Patch Panel, P/N 476TM-612
- 6-Way CATV Splitter, P/N 47690-6C2

This infrastructure will accommodate a maximum of twelve telephone locations or twelve data locations, and six video locations. You can expand the system to accommodate more telephone, data networking, and video locations by adding more components.

4.1.3 Covers and Vented Doors

The vented hinged door provides improved airflow and cooling of active gear, and is available for all Leviton STRUCTURED MEDIA enclosures.

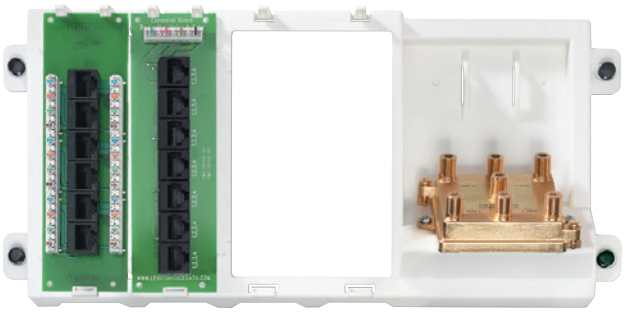
Details

- 180-degree hinged cover allows for quick and easy access to network equipment
- The ABS vented door features Tri-Plane Heat Dissipation, which promotes better intake of cool air and outward flow of warm air, extending the life of active equipment

Installer Tip:
For both basic and residential, Leviton recommends a minimum of Cat 5e or Cat 6 twisted-pair cable for telephone and data; RG-6 quad-shield coax cable for video cable, CATV, TV, DSS, and monitoring; and 16/2 or better class III stranded copper for speakers.

4.2 Data and Telephone Distribution

Leviton makes your work easier by offering Pre-Configured Structured Cabling Panels assembled from the most popular distribution modules. These are your system's basic building blocks. The panels and modules can be combined easily to meet any job's specifications.



These panels include combinations of the following modules:

- 1x9 Bridged Telephone Module bridges up to four telephone lines and out to nine telephone jacks (Please note that bridged telephone connections are for voice only and do not conform to the ANSI/TIA-570 standard for Cat 5e or Cat 6 data wiring; these bridged telephone lines cannot be tested for Cat 5e or Cat 6 compliance using Cat 5e or Cat 6 field test sets
- Cat 5e Voice and Data Module with six Cat 5e or Cat 6 ports allow for basic home networking (data, phone, fax, or modem) and can be connected to a Telephone Distribution Module or network switch
- 1x6 Video Splitter that is suitable for both cable TV and off-air antenna signals

➡ **Take Note:** *Both the Bridged Telephone Module and the Cat 5e Voice and Data Module are available as stand-alone units, and can be used for expansion or special applications, when properly mounted and installed.*

Each STRUCTURED MEDIA enclosure comes with pre-formed holes, spaced to accept the snap-in plastic connectors mounted on Leviton's modules and Pre-Configured Structured Cabling Panels.

Installer Tip:
Leviton Pre-Configured Structured Cabling Panels combine the most popular distribution modules into single units that will suit the needs of many of your customers. These panels can always be replaced or supplemented with individual modules should your needs change in the future.

4.2.1 QUICKPORT Panel Solutions

Leviton recognizes that in some instances Pre-configured products may not offer the ideal solution for the application at hand. When supporting different port counts or higher grade connections like Category 6A Leviton offers a dense 12-Port QUICKPORT panel suitable for incorporating QUICKPORT Category Jacks, AV Connectivity, or a mix of both.

4.3 Distributed Video (CATV, Other Services)

You have several options for distributing video service to more than one location:

- Install a Passive Video splitter without video amplification applicable for Cable TV applications up to 1.8 GHz
- Install a Premium Video splitter with built-in Unity Gain video amplification that automatically adjusts output levels on all ports to match incoming signal strength applicable for Cable TV applications up to 1 GHz

4.3.1 Passive Video Splitters

Leviton passive video splitters (1x6 and 1x8) are non-amplified video distribution units. Depending on your specific job or configuration, a passive splitter may not be sufficient to serve all of your intended devices with clear reception. Several factors will affect signal strength, including:

- The number of devices being served by the incoming coax cable (increasing the number of drops/splitters increases the signal loss)
- The type and quality of the cable
- The quality of the local cable signal
- The quality and workmanship of the connectorization of the cable
- The overall length the cable runs (locations at the far end of the home or furthest from the main distribution point may suffer from a drop in signal strength)

You should be aware that the CATV signal level delivered to the house will be between 0 dBmV and 15 dBmV. You can calculate the signal level based on a loss budget calculation as follows:

Total Cable Loss = (Loss in dB/100 Ft @ Highest Frequency to be Transported) x (Cable Length) x (.01)

Total System Loss = Total Cable Loss (above calculation) + Splitter Loss (from table below)

Service Type	Frequency	Insertion Loss (dB)	
Digital Cable	50 MHz	1x6	1x8
		-8.9	-10.0
	1000 MHz	-10.0	-11.0

4.3.2 Amplified Video Splitters

The Leviton Amplified CATV module is designed to split incoming coax signal from an antenna or cable TV provider with no loss. These unity-gain devices available in 8-way and 16-way configurations and are ideal for OTA and DOCSIS applications supporting frequencies up to 1GHz.

4.4 AC Power Module

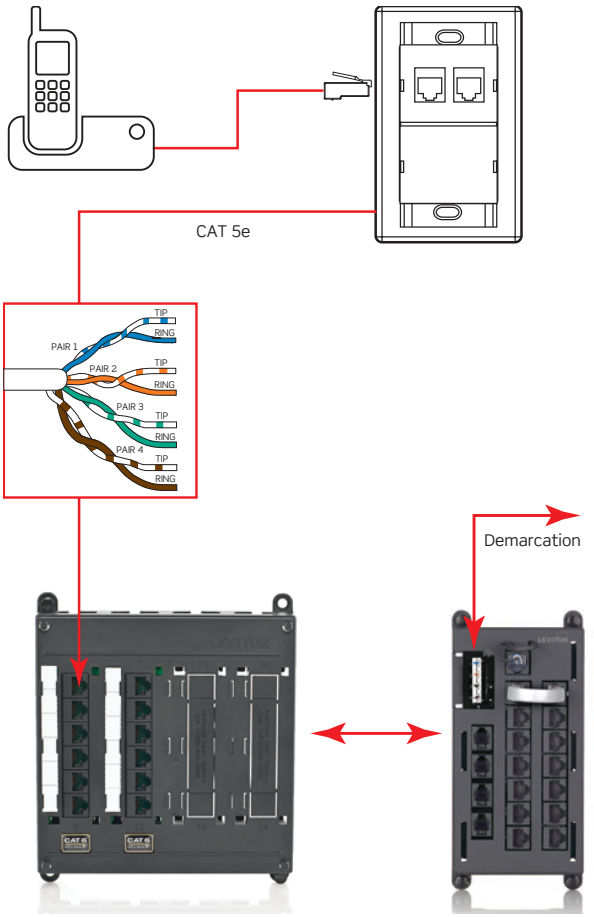
The AC Power Module 47605-ACS, which fits into an opening at the bottom of the STRUCTURED MEDIA™ enclosure, consists of two 15 AMP Commercial-Grade Surge Protective outlets inside a steel enclosure. Some features of the AC Power Module include:

- A green indicator light showing surge protection
- An audible alarm that is set off when the indicator light flashes, signifying that the receptacle is no longer offering surge protection
- The device continues to function as a standard AC outlet at its 15-amp rating when protection is lost
- The alarm can be shut off, but it cannot be reset. The Power Module must be replaced in order to maintain surge protection.
- Duplex Surge Receptacle is UL 1449 Listed

4.5 Premium Home Cat 5e or Cat 6 Platform

Leviton offers components for superior voice and data connections in its Premium Residential Platform as part of the Twist-and-Mount panel system.

1. Telephone Input Distribution Board distributes up to four (4) lines throughout a home or office to 12 locations. This module does not stand alone, but connects to the Cat 5e / Cat 6 Twist-and-Mount patch panel, with patch cords, for easy changes. The Telephone Input Distribution Board (TIDP) acts as the initial connecting point for incoming phone lines of service. The upper test jack can be used to test the incoming dial tone for all incoming lines. The TIDP provides a security jack for interfacing with a security system, and RJ-45 input ports for easy setup using a Triple-Play or voice telephony/VOIP
2. The Cat 5e or Cat 6 Twist-and-Mount Patch Panel is used to add modular voice/data distribution. It can be used as a stand-alone Cat 5e or Cat 6 distribution device for data, or to distribute voice over Cat 5e or Cat 6 cables to wallplate locations. The punchdowns located on the rear of the panel provide an aesthetically pleasing and clean installation.



4.6 Multi-Location Networking

With the ever increasing number of smart devices, PCs, streaming boxes, etc. and the need to support remote-work, the demand for home networking is constantly growing. Cat 5e, Cat 6, or Cat 6A cable allows both high-speed and high-capacity data transfer. Patching modules and a user supplied router or network switch provide a central point from which to service multiple PCs, Wireless Access Points, and other Ethernet connected devices. Depending on the number of devices that require network access, you can choose additional patching modules to provide connectivity for all planned equipment.

The combination of structured cabling and active gear creates an in-home Ethernet data network that can be used to easily connect numerous devices throughout the home.

Installer Tip:
Leviton recommends use of its Vented STRUCTURED MEDIA Door for all applications where active gear is mounted in an enclosure.

4.7 Wallplates

Leviton offers a broad selection of at-the-wall connection options designed especially for the residential market. QUICKPORT wallplates offer the ultimate in quick installation. And the designer styling, durability, and easy cleaning make Leviton wallplates a favorite among discerning homeowners. Leviton QUICKPORT wallplates can be configured to support AV, Data, Telephone, and CATV connectivity.

- These wallplates can be configured to support audio connectivity in a single or dual-gang format housing. Multiple flush-mount configurations are available in a variety of colors.

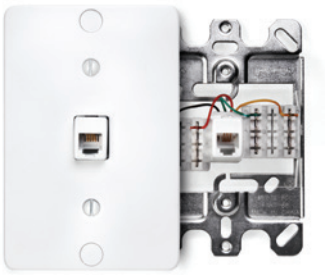
4.7.1 QUICKPORT DECORA Plus® Wallplate Inserts and Wallplates

The DECORA system offers the maximum in configuration flexibility, provided as single- or double-gang wallplates and accommodate 2-, 3-, 4-, or 6-port inserts that secure any combination of QUICKPORT snap-in modules. Inserts are sold separately from wallplates. DECORA inserts can be mounted in multigang DECORA wallplates for applications requiring higher density.

All Leviton wallplates are UL listed, conform to NEMA and ANSI standards, are easily cleaned, and come with mounting screws.

4.7.2 Wall Mount Telephone

For legacy telephone applications, use the Wallphone Screw Terminal Jack that includes a traditional wallplate in ivory or white and mounting screws.



Recommended Accessories and Tools

An installer with the highest skill level can't make up for inferior equipment or tools. The old adage about using the right tools for the job certainly applies to installing the structured cabling and components that make up modern-day data, telephone, and media networks. Leviton provides the appropriate tools for category-rated connectivity systems; tools that help the installer to do a superior job. Not only will your work be easier to perform, but you are also more assured of full system integrity.

After the system is installed, the next step is testing the cable runs. The testing equipment recommended by Leviton helps you quickly isolate common wiring faults and inadvertent wire damage sometimes caused by other trades on the job. This section will cover the recommended installation and testing tools, as well as accessories to secure your cable as you route it throughout the job.

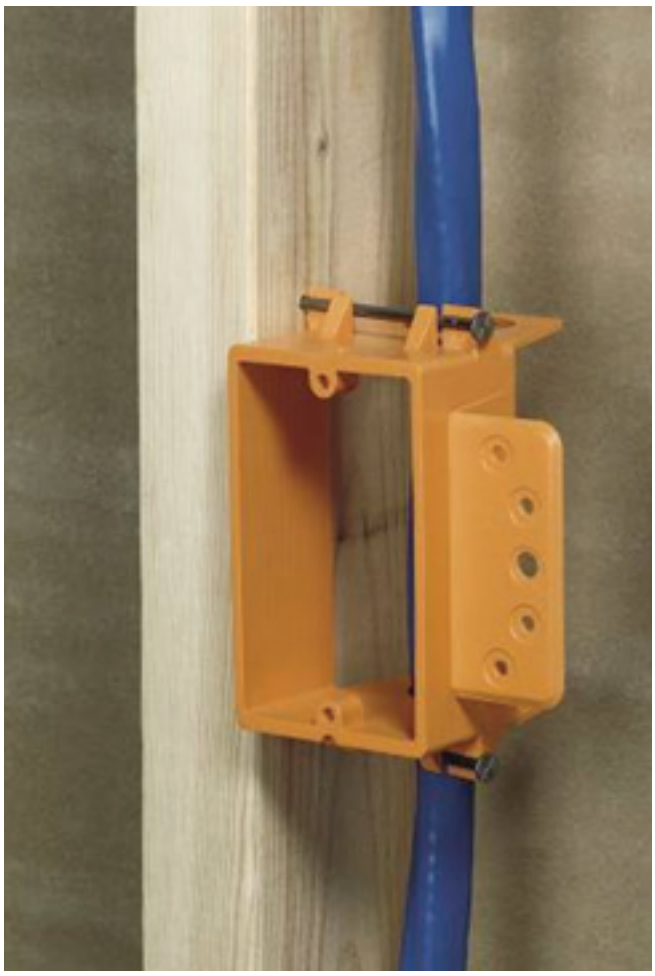
5.1 Mud Rings Instead of Electrical Boxes for Drop Locations

Unlike standard AC wiring, low-voltage wiring on its own does not require any type of outlet box. An AC device that supplies power to low-voltage wiring, such as the Leviton AC Power Module, will always be housed in a box as per the NEC®. An unrelated AC device, such as a light switch, can also share a box with low-voltage wiring (not a preferred practice), provided there is a physical barrier between the two devices.

Leviton recommends a mud ring instead of electrical boxes for the low-voltage wiring when allowed by local codes. Using a standard mud ring at the termination point of low-voltage wiring offers three immediate advantages:

- It allows more room for space consuming devices such as a security camera and connection points
- It permits the installer to leave a long cable service loop or (spare cable) inside the stud cavity
- It makes it easier to maintain minimum cable bend radii behind the wallplate

A mud ring, like a standard outlet box, provides a sturdy surface for attaching a device or cover plate. Mud rings are available for both new construction and remodeling in existing walls.



Installer Tip:
Leviton recommends that you leave a 36-inch service loop for fiber optic cable and a 24-inch service loop for all other cable. This gives you plenty of spare cable to correct wiring errors and for future expansion should the end device need changing.

5.2 Cable Management

Category cable is manufactured to deliver high-speed performance and does its job best when it's handled appropriately. It is not a forgiving material medium that can be pulled, stretched, and stapled the same way as standard Romex®. A light touch on the installer's part goes a long way towards guaranteeing system integrity and performance.

Leviton recommends the following materials for cable installations:

- J-hooks and similar cable supports instead of staples for supporting cable along joists
- Cable clamps on individual cable runs
- VELCRO® tie wraps and cable straps for wrapping multiple cables and for securing cable to studs

Standard staples are not recommended. The methods recommended here are more forgiving. The cost of time spent tracing down and replacing one damaged cable will surpass any lower material expense or labor cost saved by using less expensive staples.

5.3 High-Flex Patch Cables

Leviton High-Flex Cat 6 patch cables feature a small diameter cable, allowing for tighter radius connections and a cleaner finished appearance inside a dressed STRUCTURED MEDIA™ Center. Various color options are available to distinguish between connections.

5.4 Tools for Termination

Good, clean jacket removal and termination assures that every wire connection is made with full contact between the wire end and its termination point. This technique results in a high-quality connection that cannot be obtained when a wire is nicked or poorly stripped. Leviton offers several termination tools for Cat 5e or Cat 6 cable including:

- Palm Termination Tool
- Punchdown Tool (used with a 110 IDC blade)
- EZ-RJ45® Crimp Tool

The punchdown tool presses wire conductors into place in Insulation Displacement Connectors (IDCs) and in QUICKPORT™ modular snap-in jacks. It will also trim off the ends of the wire conductors. The punchdown tool assures solid connections on an array of wire termination blocks. A push on the tool's handle using a 110 blade will easily terminate 22-, 24-, or 26-gauge solid wire into 110-style IDC punchdowns as found on Leviton Cat Cat 5e, Cat 6, or Cat 6A connectors and modules.

ANSI/TIA 570 standard recommend the use of 8-conductor connectors only with a T568A wiring pattern on both ends.

Installer Tip:
Be sure not to bend cable during the installation process. The integrity of cable is important for maintaining optimal levels of performance.

Installer Tip:
Category cable requires precise termination. Removing too much insulation can adversely affect the efficiency of the cable. Tools manufactured specifically for trimming low-voltage cable will work more precisely than knives or diagonal cutters.

5.5 Tools for Stripping

The recommended terminations for video (broadband) wiring is a compression lock male F-type connector at both ends of the cable. The small amount of extra installation effort will pay off in the end.

Leviton recommends a high-quality, commercial grade stripping tool for stripping all RG-6 quad shield cable, and a comparable crimping or compression tool for assembling the connector.

For category cable (Cat 5e & Cat 6) a suitable, commercial grade, stripping tool should be selected (such as the Leviton 49660-P). For Category 6A Cabling a commercial grade specialty stripper may be needed due to the larger OD and thicker jacket of 6A cabling.

5.6 Tools for Testing

Category cables should be inspected throughout the installation. This is much easier than trying to trace down a problem later within a bundle of cables. Good testing equipment will:

- Help keep your installation compliant with the applicable standards (Cat 5e, Cat6, Cat 6A)
- Find any errors or disruptions
- Point out problems in your installation techniques so they can be corrected
- Add value to your installation

When field-testing Category cable installed for data transmission:

- Use a category cable field test set for testing all cables installed for data transmission. Select a test set from a reputable manufacturer and follow the manufacturer's instructions
- Only those cable runs with RJ45 Plug or Jack connectors available on both ends of the run (wallplate Cat 5e, Cat 6, or Cat 6A connector and matching category module or connector at the STRUCTURED MEDIA™ enclosure end) can be tested for Cat 5e, Cat 6, or Cat 6A compliance

Coax cable can be tested for breaks in the cable itself and for cable resistance. Breaks can be checked using a multimeter or coax cable tester. The multimeter also checks for resistance.

5.7 Test Equipment for Telephone Installations

Telephone test equipment is available from a number of reputable manufacturers. Two common instruments are the Tone Test Set and the Inductive Speaker Probe. Used together, these instruments will:

- Locate individual wires in a horizontal run along with any breaks or terminations that might be present
- Test for continuity
- Check for shorts and opens
- Identify Tip and Ring polarity
- Identify the line condition for CLEAR LINE with dial tone, BUSY LINE, and RINGING LINE

Ensure test equipment is obtained from a reputable supplier and is commercial grade. The proper test equipment will aid in quickly resolving cable issues that may come up during installation and testing..

Installer Tip:
Cable should be tested regularly during installation so any problems can be repaired early in the job.

5.8 Other Tools for Pre-Wire (Rough-in)

The following list includes tools normally found useful in the pre-wire or rough-in stage of installation.

- Labels (for labeling cable)
- Drill
- Drill bits (assorted)
- Extension power cords
- Screw driver set (regular and phillips)
- Pliers
- Hammer
- Wire snips or wire cutters
- Wire fasteners for Cat 5e or Cat 6 and RG-6 quad-shield coax cable
- Measuring tape
- Level (six inches)
- Punch (for steel studs)
- Grommets (for steel studs)
- Tape (electrical and other)
- Permanent marker
- Flashlight
- Ladder
- Broom and dust pan
- Electric drill
- Keyhole drywall saw
- Wire cutters
- Cat 5e or Cat 6 UTP stripper
- Impact/punchdown tool with 110 bit and blade
- RG-6 quad-shield coax stripper
- RG-6 quad-shield coax F-connector crimper
- 6- and 8-position telephone and Cat 5e or Cat 6 plug crimp tool
- Leviton Punch-Down Tool for Cat 5e or Cat 6 connector termination
- Utility knife
- Fish tape
- Level (six inches)

5.9 Check List

Accessories and Tools

Objective:	Use This:
Termination Point	Mud ring
Cable routing and support	J-Hooks Cable Clamps VELCRO® Tie Wraps and Cable Straps
Category cable cutting tools	UTP Stripping Tool Impact 110 Wire Punchdown Termination Tool
Category cable termination	1x9 Bridged Telephone Module Cat 5e or Cat 6 Voice and Data Module Cat 5e, Cat 6, or Cat 6A cables
Coax cable cutting tools	Coax Stripping Tool Coax Crimping or Compression Tool Coax Cable Cutter

5.10 What You Need to Know

- Mud rings are ideal termination hardware for low-voltage wiring
- Structured wiring is not as hardy a material medium as standard AC cable; it must be carefully supported and routed so the cable integrity stays intact
- Specific testing and termination tools for low-voltage wiring help assure a clean, trouble-free installation

Cable Testers – Manufacturer Listing

The following companies manufacture handheld cable testers. This information is listed as a courtesy for your reference only and is not an endorsement nor a recommendation. You are advised to contact each company directly to request detailed information about their products.

Softing IT Networks

7209 Chapman Hwy
Knoxville TN 37920, USA

Customer Service:
1-865-251-5252
sales@softing.us

itnetworks.softing.com/us/

Fluke Corporation

6920 Seaway Boulevard
Everett, WA 98203
United States

Customer Service:
1-800-283-5853

flukenetworks.com

TREND NETWORKS

300 Roundhill Drive, Suite 1,
Rockaway, NJ 07866, USA

Customer Service:
1-877-390-6161
contactus@trend-networks.com

trend-networks.com

6. System Design

System Design and Placement – Laying Out the Basics

Low-voltage cable means connectivity. Structured wiring today means Ethernet connections, Internet-connected TVs, dedicated data lines, multi-room audio, streaming video, Wi-Fi®, online gaming, VOIP, and more. It's increasingly important to carefully design your system and write up a plan for cable, device, and distribution center placement. Technology is always moving forward and becoming faster, and it's best to plan ahead for the rising demand homeowners put on their networks. With the median size of newly constructed homes in the U.S. at 2,300 square feet (suggesting both more and larger individual rooms) and with condominiums and apartments becoming increasingly "tech wired," your plans will include plenty of structured cable. This section will deal with the basics of your low-voltage wiring plan.

6.1 Laying Out the Basics on the Floor Plan

A well-prepared floor plan done in advance of your installation will save you headaches later. It isn't enough to simply plan one phone jack or cable TV termination per room. Your plan, or a designer's plan, must be thoroughly discussed. This plan should include:

- The specific locations for each type of device (data/Ethernet, coaxial/CATV, audio, telephone, etc.)
- The types of cable that will be run to these locations and cable routing
- The local Internet Provider connectivity requirements (e.g. Coax, Single-mode Fiber, or Category Cable)
- Allowance for future expansion as your customer's needs change
- Allowance for changes as the role of various rooms change (a bedroom becoming a home office, for example)
- Allowance for multiple Cat 5e, Cat 6, or Cat 6A and coax jacks in location of planned Internet Provider Modem/Router location
- The minimum-grade cable you should run is Cat 5e

If you're unsure of a specific wall location for a device, then we suggest that two or more be installed to cover all possible choices. You can't predict furniture placement and you're better off running more cable, than coming back later to add to the run. Mark all your proposed locations with blue masking tape or similar material and do a walk through prior to installation. When your are satisfied with your plan, you can decide the best system installation for the plan requirements. Be sure to plan beyond the basics. The category cabling and RG-6 coax cabling will cover three applications: telephone, data, and coax video (CATV) distribution. Additional applications such as multi-room video, multi-location stereo, and home monitoring all require additional dedicated wiring.

Remember that low-voltage structured cable requires gentler handling during installation. When developing your floor plan, be sure that you have sufficient access to pull the cable without damaging it.

Installer Tip:

While Category 5e is still a common media in residential construction Cat 6 and Cat 6A are better positioned to support current and future bandwidth trends. Leviton recommends a minimum of Cat 6. ANSI/TIA 570 2018 (Residential Telecommunications Infrastructure) recognizes Cat 6A as the minimum requirement for twisted-pair cabling in new home construction.

➡ **Take Note:** *For assistance with system design, visit the online configurator homepage at leviton.com/homeconfig.*

6.2 Location Matrix by Type

Location will depend on the floor plan, but you can assume the following:

- Install a mud ring for one phone and one data port per room
- Allow for one audio/video device per room
- Allow for one analog volume control wall unit per stereo speaker zone requiring a volume control
- Every room with a security camera will require one mud ring at the camera location
- Install a mud ring for 1 or 2 data ports at locations intended for Wireless Access Points

Installer Tip:
You can use a standard electrical box if you do not have a mud ring. However, be sure to remove the back section from the electrical box first. This will allow you to leave a service loop in the wall while providing a mounting surface for your device and cover plate.

Installer Tip:
As you'll see in Section 8, be sure to run your low-voltage wiring in a separate stud space from the AC cable. Be sure your mud ring locations keep this rule in mind.

6.2.1 Number per Room

The ANSI/TIA Residential Telecommunications Infrastructure Standard suggests the following in regard to telecommunications cabling:

- A minimum of one Ethernet outlet location (where applicable) in the kitchen, each bedroom, the family or great room, and the den or study
- Sufficient outlets in each of these rooms along any unbroken wall spaces measuring twelve feet or more in length
- Additional outlets as needed so that no point along the floor line in any wall space is more than twenty-five feet, measured horizontally, from an outlet location in that same space

Installer Tip:
Placement of Low Voltage outlets near baseboard heaters should be avoided. Many such appliances manufacturer's instructions disclaim placement of outlets above the appliance as connected cordage can be damaged. The same applies to Low Voltage cabling, connectors, and patch-cords.

6.3 Cabling Types and Counts for Each Location

AC wiring varies by gauge size. The end-use device or appliance dictates the capacity amperage of the circuit and thus your choice of cable (14/2, 12/2, etc.). Low-voltage wiring varies by type and, to a lesser extent, by gauge (most will normally be 22 - 24 gauge).

ANSI/TIA 570 proposes different grades of residential cabling depending on the services the cable will be providing within a residence. There are three grades:

- Grade 1 meets the minimum requirements for telecommunication services. It can support telephone, CATV, and typical data applications. These minimum requirements are a four-pair 100 ohm UTP that meet or exceed Cat 6A transmission requirements and 75 ohm coax cables.
- Grade 2 and Grade 3 meets all of Grade 1 requirements as well as multimedia applications and fiber optic wiring. The minimum cable requirements for each cabled location are two four-pair 100 ohm UTP cables that meet or exceed Cat 6A cable and two 75 ohm coax cables. Two-strand optical cable is an optional cable for Grade 2 installations and a requriement for Grade 3.

Installer Tip:
Leviton strongly suggests that a minimum of 2 UTP and 2 coaxial cables be provided in line with Grade 2 requirements and that a minimum of Category 6 media be used.

Installer Tip:
Make sure all wire and cables meet all local safety and fire codes, and make sure that they are rated for in-wall use. Approved wire and cabling will feature a classification (such as CL-3, or Class 3) to indicate suitability for installation. Failure to follow this guidance could result in exposure to insurance and even legal risks.

6.3.1 Telephone and Data Cable: Cat 5e, Cat 6, or Cat 6A

Always use a minimum of Category 5e, Leviton recommends Cat 6 or Cat 6A, for these applications.

6.3.2 Video Cable for CATV, TV, DSS, and Video Monitoring: RG-6 Quad-Shield Coax

For distribution of broadcast and cable TV, install RG-6 quad-shield coax cable. RG-59, once commonly used by cable companies for basic service, is now recommended only for short, component-to-component runs (such as behind an entertainment center). It is barely worth an installer's trouble to stock this second cable variety for such minor installations and much easier to stick with RG-6 quad shield for all your coax needs. If the installation calls for it, direct burial coax cable is available.

6.3.3 Cable for Video Home Monitoring Camera

Run a single Category cable to each potential camera location. Remember to leave enough extra cable length at each end to allow for any possible future relocation.

6.3.4 Speaker Wire for Multi-Room Audio

Speaker wire ranges from a concert-blasting 8-gauge stranded silver copper cable to a more modest 22-gauge copper (remember, the heavier the wire's gauge the lower the number). Leviton recommends a 16/2 or better stranded copper, class 3 cable for high-fidelity reproduction. Class 3 refers to the cable's fire rating. Class 2 is the minimum acceptable by the NEC®. Only use wire cable marked with at least a CL 2 or CL 3 rating. If you are planning to pre-wire to volume control and speaker locations, it is best to run speaker wire separately from other low-voltage cabling.

Installer Tip:
Be sure to follow the speaker manufacturer's guidelines for wire gauge, and the amplifier manufacturer's recommendations for acceptable impedance loads.

6.3.5 Multi-Room Audio Application

If wiring for multi-room audio determine where the central distribution equipment will be located and provide the necessary number of two-pair audio cables required. Depending on the chosen manufacturer's equipment this may be housed in the Leviton SMC or externally. Refer to the chosen Home Audio system's instructions and specifications and contact Leviton for assistance with integration with the Leviton Structured Media system as needed.

6.4 High-Speed Optical Fiber Cable

Although this manual does not deal directly with high-speed optical fiber cable, we recognize that an installer might be asked to install it as a primary system or as an addition to an existing one. Optical fiber converts electrical video/data/voice signals into pulses of light that are then beamed through a thin glass cable. The advantages to optical fiber cable include:

- Noise immunity (is not affected by electromagnetic induction or EMI)
- Low signal loss
- No short circuits, as it does not carry an electrical current
- The ability to carry more data, faster, with higher bandwidth than copper

The ANSI/TIA-568-C standard recognizes several grades of fiber optic cables:

- 9/125um single-mode optical fiber
- 50/125um laser optimized multimode (OM3 or OM4)

Leviton offers a complete line of fiber optic terminations and patching solutions. For more information, please contact Leviton Technical Support at (800) 824-3005.

Installer Tip:
A common fiber application in today's new construction is to provide a termination point for incoming FTTx (Fiber to the Home or Premise) connections from Internet Providers. Leviton's FTTH premise box provides a convenient solution that can be placed within a STRUCTURED MEDIA Center or externally on any interior wall.

➡ **Take Note:** *Your local Authority ultimately determines the rules and guidelines that must be followed when installing either AC cable or low-voltage wiring. Always refer to the Local Code in effect and the Local Authority before starting your installation.*

6.5 System Choices and Options

The Leviton Connected Home STRUCTURED MEDIA™ system offers a complete convenient array of distribution panels and devices to manage your telephone, data, and audio/video requirements. Options range from basic phone, Internet, and cable TV to more advanced applications such as complete home office connectivity or wireless mesh wired back-haul connectivity. These systems need to always start with one of the following STRUCTURED MEDIA Centers:

Wireless SMCs (ABS Polymer Construction)

- WSMC 14" Enclosure
- WSMC 28" Enclosure
- WSMC 42" Enclosure

Metal SMCs (Steel Construction)

- SMC 14" Enclosure
- SMC 21" Enclosure
- SMC 28" Enclosure
- SMC 42" Enclosure

These systems also have several different options for covers: basic, hinged, and premium, as well as vented doors and extension rings (note that not all options are available for all enclosures).

The primary difference among the SMCs is their size: the larger the box, the more modules and panels it can hold. In addition, (all SMCs have surge-protected AC and non-

surge protected power options to accommodate multiple active devices). There is virtually no limit to the size or complexity of the system you install in a normal residence. Every room can be wired for data, telephone, and multi-media. Unlike AC wiring, where you must meet mandatory spacing requirements for devices and minimum installation standards, residential structured cable standards are more versatile.

➡ **Take Note:** *The key to structured wiring is to have a single distribution center as the point of origin for your cables rather than a series of standalone modules. For easier, ongoing management, updates, and troubleshooting, make sure all modules are installed in a STRUCTURED MEDIA Center.*

Installer Tip:
Plan to install additional SMCs for audio/video distribution should your needs exceed the capacity of a single unit. A multi-bay connection tube is available to interconnect WSMCs mounted vertically adjacent in a stud bay.

6.5.1 General Location

The SMC can be located in any well-lit area that will give you clear access to it and allow you to easily remove the protective cover. The SMC should **not** be located:

- On an outside wall
- In an uninsulated garage wall
- At an extreme distance from connections at wallplates
- Next to main AC panel

Some of the NEC® (Section 110-26) rules for placement of a service panel include:

- Do not install your SMC above major appliances, such as a clothes washer
- Avoid moist locations, such as a bathroom or in a wall over a sink
- The space in front of the SMC should not be used for or cluttered with stored items
- Do not install in a fire-rated wall

Mount the SMC in an area central to the rooms that will be served in the home. This is to keep all the cable runs as short as possible to assure better system performance. Remember, all category cables must be no longer than 295 feet.

ANSI/TIA 570 recommends that an electrical outlet be near your SMC for Grade 1 installations and mandates it for Grade 2 and 3 installations. For your convenience and upgrade capability, Leviton recommends using an SMC Power Module with an independent 15-amp circuit.

6.5.2 Horizontal Location

Be sure that the SMC is not installed in the same stud space as an AC cable.

Installer Tip:
You want to keep electromagnetic interference (EMI) to a minimum (a five-foot separation is considered minimum). Mount the SMC in an accessible, centrally located, interior wall that does not require a two-hour fire rating.

6.6 STRUCTURED MEDIA™ Components and Devices

The neat and orderly placement of modules, switches, and cable within a STRUCTURED MEDIA Center accomplishes several goals:

- It's easier for the installer, homeowner, and inspector to review the work
- The installer can better trace the system and any problems that might arise
- Allows for easier upgrades, additions, and changes

Standardizing your installations allows you to do a better job and cut down on your punch-list time.

6.7 Wallplate Configurations

Structured-wiring wallplates must accommodate a variety of snap-in modules and devices. Leviton offers both single-piece wallplates, already configured for a set number of modules, and one- and two-gang wallplates that can accept 2-, 3-, 4-, or 6-port inserts.

Pre-configured wallplates allow you to standardize port locations and speed installation. Blank wallplates give you the flexibility to tailor each location with exactly the number and type of jacks necessary. Leviton offers snap-in jacks for Category 5e, 6, and 6A Jacks, Coax, RCA, HDMI, USB, and audio connectors.

The Leviton wallplates described in the following sections serve these devices:

- High-speed data/Ethernet Cat 5e or Cat 6 minimum.
- Telephone and fax (Cat 5e and Cat 6 connectors)
- Devices (USB connectors)
- Standard Video ports (F-connectors) and HDMI® ports
- DSS with Video and Telephone (F-connectors and Cat 5e connectors)
- Speaker terminals (binding posts)
- Audio/video jacks (RCAs and BNCs)

- Fiber optic connections SC, LC, or ST

6.8 What You Need to Know

- Lay out your floor plan, including device locations and cable routing, before starting any structured cable installation; review your plan thoroughly
- Plan Infrastructure wiring (phone, data, and coax video), plus any additional wiring needed for applications (multi-room audio stereo, home monitoring, multi-room video, etc.)
- Install an appropriate size SMC for current use and future expansion
- Use mud rings whenever possible instead of standard electrical boxes

Installer's Checklist:

Cable Usage:	Recommended Type:
Data	Category 5e, 6, or 6A
Telephone	Category 5e, 6, or 6A
CATV, TV, DSS, and Monitoring	Quad-Shielded RG-6 Coax
Video Monitoring Camera	Category 5e, 6, or 6A cabling or RG 6 Quad Shield
Speaker Cable	Minimum 16/2 stranded copper, class III

7. Pre-Wire

Installation, Labeling, and Documentation of Pre-Wire Installation

The integrity of any electrical wiring system is highly dependent on the quality of its installation. Even the best components will perform poorly if they are installed incorrectly or carelessly. Every step of the installation, from running the cable to installing the wallplates, should be done according to code and industry standards. This section will address these installation procedures. It is in the installer's best interest to follow these procedures to avoid mistakes and repairs to the system.

Category rated unshielded twisted-pair (UTP) cable is the mainstay of low-voltage wiring. Even though its four pairs of wire are color coded, there can still be some confusion when installing them at terminal devices, or when future changes are done to the system. Add to this multiple terminal devices, coax cable, and any other existing UTP cable and the importance of labeling each cable becomes self-evident. Labeling and documentation will assist in troubleshooting and making future changes to the system.

7.1 The Walk-through

A pre-installation walk-through during the framing stage will do the following:

- It better familiarizes the installer with the job
- It allows a comparison between the plans and any changes to the building construction
- It allows the installer, general contractor, designer, and customer to alter the proposed installation or head off any foreseeable problems or conflicts
- It gives the installer an opportunity to formulate a work plan

If the installer is a separate contractor from the electrician, the two contractors will have to coordinate their respective installations to avoid problems with locating devices and sharing stud and joist spaces. In fact, the installations of AC and low-voltage wiring are often done at the same time. If they are done separately, the low-voltage follows the AC.

A walk-through also allows the installer to mark off locations for mud rings and the SMC. At this point, the rough-in wiring can begin.

7.1.1 The Reality of the Job and the Installation

The definition of the ideal job depends on the trade. For an electrician or an installer of structured cable, it would mean unfettered access for routing cables and no damage to their work by other contractors' trades. A realistic installation has two phases, the Rough-In and the Final Testing and Connections:

The Rough-In:

- The low-voltage cable is carefully installed, observing all routing/handling rules and standards, and then visually inspected
- Any damaged or questionable cable is replaced, never spliced or repaired
- Steel nailing plates are installed anywhere the cable can be damaged by a screw or nail through a framing member
- Both ends of each cable run are left with sufficient excess cable and service loops that are then wrapped and protected in plastic bags or similar material until other trades have finished their work

Final Testing and Connections:

- The cables are connected and tested, and the system is checked for damage; if damage is detected, the installer then negotiates the repairs with whoever caused the damage

The best way to avoid damage and costly repairs to ports, wallplates, and STRUCTURED MEDIA™ enclosure contents is to protect all your cables and regularly discuss with other trades the importance of protecting these cables as well (you also want them to report any damage to you when it happens so you can repair it while the walls are still open).

Installer Tip:
No job will go flawlessly, but good communication skills coupled with your own vigilance will keep problems to a minimum.

Installer Tip:
Using two-way communication devices during testing will easily allow the installers to talk with each other during testing.

7.2 Mud Rings

Leviton recommends using mud rings rather than receptacle boxes to terminate your low-voltage cable. Aside from acting as mounting hardware for a device and wallplate, a mud ring allows complete access to the stud or joist space for storage of the service loop which in turn means less danger of damaging the cable. Mud rings are available at electrical distributors, home centers, and wherever drywall supplies are sold.

In some localities, the code mandates electrical boxes and conduit for low-voltage wiring. Always check your local regulations before installing low-voltage cable.

If electrical boxes are required, use the deepest 4-square boxes available to allow for cable bend radius and service loop.

What You'll Need to Install Mud Rings or Electrical Boxes:

- Room locations for mud rings or boxes
- Measuring tape
- Small carpenter's level
- Screws or nails for attaching to framing members
- Drill or hammer

7.2.1 Location of Mud Rings

Every wallplate location will require a mud ring, as will any empty conduit run for future wiring purposes. The floor plan will indicate specific locations. Mud rings should be located away from AC wiring and devices, baseboard heaters, and potentially wet areas such as sinks. Distances from the floor will be determined by:

- Convention, using AC wiring standards
- Specifics of the job
- Matching existing devices

7.2.2 Mounting

Metal mud rings are typically nailed to framing members prior to the installation of drywall. Retrofit or low-voltage rings can also be installed in existing walls during remodeling work. Use a small carpenter's level when mounting to assure a level and straight installation.

The bottom of the mud ring opening should match the height of the bottom of electrical boxes for consistency. This height varies from approximately 14 to 16 inches from the floor for most walls. A height of 46 to 48 inches is used for volume controls, wall phones, and other hand-control devices, or at the same level as light switches. Special locations such as built-in cabinets and shelves for home entertainment systems may require other heights. Be sure to check with your builder for any special instructions.

Installer Tip:
Even the best technical installation can be marred by sloppy trim work. A crooked mud ring will yield a crooked wallplate. Take your time and mount the mud rings carefully.

7.2.3 Installation Height Above the Floor

It's difficult to state any hard and fast rules regarding the location of most mud rings. In a children's playroom, for instance, you might want a wall phone installed lower than the 48-inch standard height. The height of a counter or backsplash, or the location of a sink for that matter, will determine the placement of mud rings in a kitchen. Using AC wiring as a guideline, you're safe installing mud rings at the following heights measuring from the floor to the bottom of the mud ring opening:

- Wall phones: 48 inches
- Desk phones and fax, data ports, audio/video, and floor-mounted speakers: 15 inches or the same height as to the bottom of installed electrical outlet boxes
- Wall-mounted speakers: vary by design and plan
- Volume control for speakers: same as to the bottom of electric light switch boxes
- Wall-mounted security camera: varies by design and plan

7.3 STRUCTURED MEDIA™ Center

Proper mounting procedures, and installing the optional AC Power Module.

7.3.1 Location Matters

Each job and building design will determine the location of your Leviton SMC. Location guidelines were mentioned in Section 6. To summarize:

- Do not mount the SMC in a fire-rated wall
- Choose a dry, well-lit room
- Be sure you have convenient access to the SMC for future additions of structured cable
- Keep a minimum distance of five feet between the SMC and the service panel
- If possible, consider a central location that will result in the shortest distance between the SMC and the structured cable termination points
- Mount the top of the panel approximately five feet from the floor

A room over an unfinished basement or crawl space or under an open attic space will allow structured cable to be installed in the SMC at a later date if expansion or updates are desired. Typical locations include utility rooms, closets, and basements, but any room can be used.

Installer Tip:
An open, clear space in a closet makes a fine location for an SMC. For maximum flexibility, install a removable wood panel above and below the SMC, thus providing access to the wall cavity. This makes future cable installations considerably easier.

7.3.2 Mounting your SMC

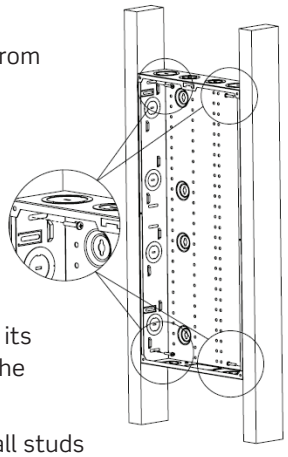
There are two ways to install a SMC:

1. Flush mounting between wall studs
2. Surface mounting

What You'll Need to Mount Your SMC:

- Tape Measure
- Drill and bits
- Mounting screws
- Hammer
- Pencil or marker
- Shims
- Plywood or 2x4s (for surface mounting)

To flush mount a SMC:

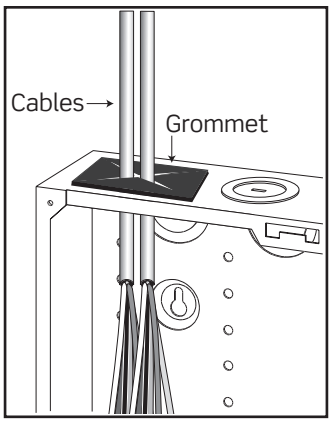


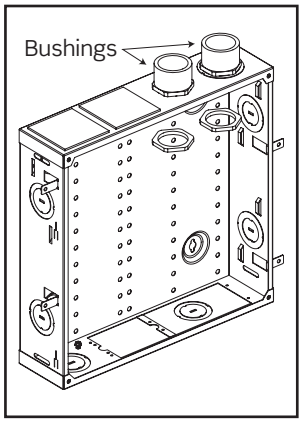
1. Remove required knockouts from the unit prior to installation
2. Allow 12 inches of access above and below the unit for conduit fittings, cable routings, and, if called for, the installation of a power module
3. Position the SMC unit so that its top is about five feet above the floor
4. Hold the unit between the wall studs with mounting tabs, folded out against the studs to accommodate any drywall installation
5. Mark the knockout locations on the wall studs if using side-wall knockouts (metal SMCs only)
6. Remove the SMC and drill out the studs at the knockout locations
7. Insert the SMC between the studs
8. Install the wood screws that come with the SMC (metal SMCs only) through the mounting tabs (shimming may be required if studs are warped or twisted), for Wireless SMCs source suitable mounting fasteners for your application.

To surface mount the SMC:

1. Provide some structural support in the form of bracing (such as 2x4s between the studs or a piece of ¾-inch plywood)
2. Remove any required knockouts
3. Position the SMC unit so that its top is five feet above the floor
4. Mount the SMC using the keyhole-mounting holes on the back of the unit with provided or user selected fasteners, secure to the plywood or framing

Installer Tip:
Use the cardboard mud guard to cover and protect the interior of the box and unterminated cables during drywall finishing. The mud guard will defray damage from other contractors and workers on the job. Store the SMC metal cover, in its original plastic protective covering, in a safe place until ready for trim out.





7.3.3 Grommets or Plastic Bushings

Leviton requires the installation of protective grommets or plastic bushings at every metal SMC knockout. This protection will prevent damage to the cables as they enter the SMC. Without grommets or bushings, the insulation on the cable can tear or otherwise be compromised if it is pulled against the bare edge of the opening. The supplied adhesive backed self-healing foam grommets are ideal for protecting cables as they enter the SMC.

7.3.4 Cable Entry to the SMC

Low-voltage cables typically enter and leave from the top of the SMC. AC power cables, for the AC and Universal Power Modules available on the 14", 21", 28", and 42" enclosures, typically enter through knockouts on the bottom of the module.

7.3.5 Powering

The Leviton SMC is designed as a distribution device for low-voltage wiring only. It is not designed for the installation of standard AC cable or Romex®. When power is required for distribution modules, a Leviton AC Power Module should be installed. The AC Power Module is available with or without Surge Protection for connected equipment.

Safety Notes:

- Never wire live AC cable. The circuit must be disconnected at the breaker or fuse box and confirmed with a tester
- Communications wiring and components should not be installed during lightning storms or in wet locations (unless specifically designed for such locations)
- An installer should never touch uninsulated wires or terminals unless the wiring has been disconnected at the network interface
- A licensed electrician, or in some cases a homeowner, must connect the AC Power Module

7.3.6 Installing the Power Module

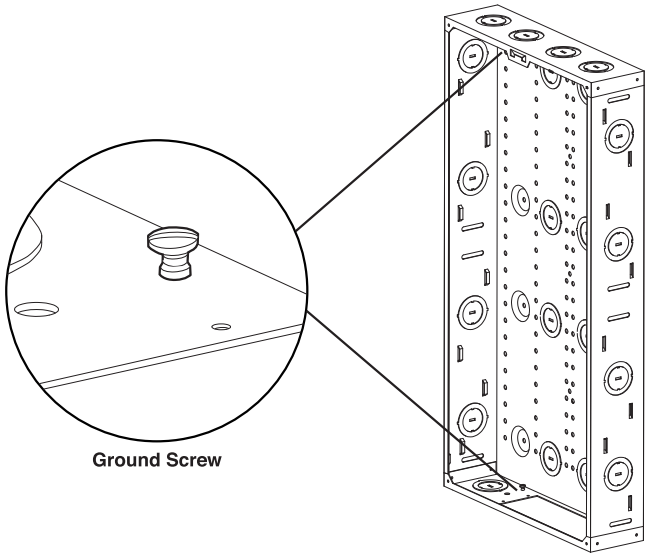
Like any piece of electrical equipment, the AC Universal Power Module should be installed following all appropriate electrical codes and safety precautions. Leviton recommends that a licensed electrical contractor perform the following steps.

- Be sure the power to the circuit is off before wiring the Power Module
- Running a dedicated 15-amp circuit to the SMC
- Using 14/2 or 12/2 electrical cable
- Cap off and safely secure until trim-off phase
- Using only copper or wire from the electrical panel

➡ **Take Note:** *Understand that the Surge Protected Power Module cannot act as a lightning arrestor (it will not provide protection for the equipment should it withstand a direct lightning strike).*

7.3.7 Grounding the metal SMC

A grounding screw can be found at the bottom of the metal SMC. An appropriate ground wire should be secured between the grounding screw and an earth ground point, such as the main electrical panel. Wrap the ground wire into the screw and tighten with a screwdriver. A minimum No. 12, solid conductor, bare copper wire is recommended to ground the unit.



7.4 Structured Cabling

A category-rated Standards compliant installation involves more than simply the use of category cable. For full compliance, connectors and cable must meet ANSI/TIA-568 electrical and mechanical specifications and transmission requirements. A category-compliant installation will minimize the attenuation, near-end crosstalk (NEXT), return loss, and signal-degrading factors that can greatly affect a system's transmission ability. Category compliance can be altered by the method of installation. Improper cable routing and support, as well as kinking, stretching, and crimping, can all negatively affect the cabling performance. Proper cable installation is critical to system integrity.

In the past, the main low-voltage appliance in a home was a telephone. Known by the acronym POTS or Plain Old Telephone Service, this system worked well for what would now be viewed as a basic, even unsophisticated single-line analog phone service. POTS used quad wire, consisting of four individual, non-twisted wires within a single cable jacket and run in a daisy chain pattern. This meant that a single wire served a long run of telephone jacks, if not all of the jacks in a home. Damage to the line could take all or many phones out of service.

Structured cable systems are not only more sophisticated and more robust than quad wire, but they use a different routing pattern as well.

Installer Tip:

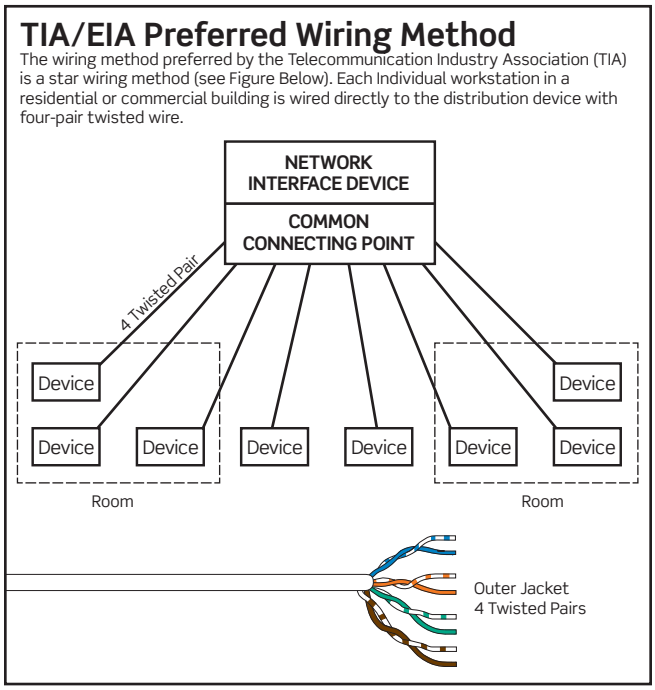
Quad wire and Category 3 cabling are not an appropriate conductor for modern multi-line installations, and will result in poorly performing telephone/modem/fax services, as it will not allow high-speed data network communications. If you run across it during remodel work, replace it with Category 5e, 6, or 6A structured cabling. Any quad wire or category 3 cabling in a category cable installation makes the entire wiring system susceptible to noise.

7.4.1 Cable Topology

Industry and association requirements, along with specifications have replaced the daisy chain wiring pattern with the star pattern, also known as the home run. Advantages of the star-wiring method include:

- Each device is wired directly to a distribution center (the STRUCTURED MEDIA™ Center)
- Service affecting problems are isolated to a single cable and thus a single device
- Troubleshooting and repair are easier because the problem can be isolated

ANSI/TIA 570 calls for star topology in all residential and light commercial cabling systems (see below).



Cable from the STRUCTURED MEDIA Center

Plan ahead. Additional runs of cable may be needed for home monitoring, multi-room video, and other applications.

Warning:

Grounding and bonding systems are an integral part of low-voltage cabling. Improper grounding and bonding can induce voltages that disrupt telecommunications circuits and create the potential for dangerous hazards to occur. Grounding and bonding must conform to all local codes and requirements and conform to ANSI/TIA-607 requirements for telecommunications infrastructure. Manufacturers' instructions must also be followed.

Conduit for Future Installations

Structured wiring should be a part of every new home. The system you install today might need enhancing and upgrading later on. For these reasons, Leviton and many contractors recommend the installation of empty conduit during the framing stage so that it will be available for future cabling. One of the best choices, and easiest to install, is ENT flexible conduit in either 1-inch or 1 1/2-inch sizes. It should be routed from the STRUCTURED MEDIA Center:

- To the crawl space or unfinished basement (if any)
- To the attic
- To the service entrance point (for telephone and cable service)

Be sure to install a pull string inside each run of conduit to assist in future cable installations.

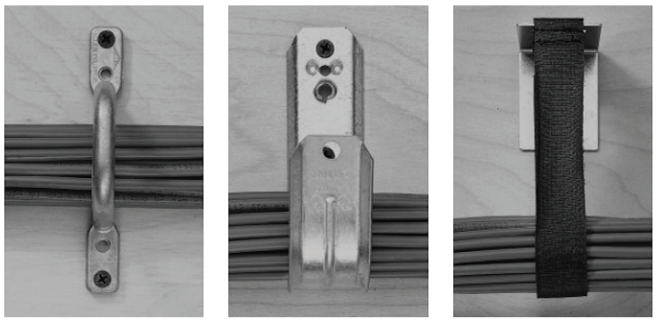
7.4.2 Cable Routing, Dressing, and Strain Relief

Category cable is manufactured to deliver high-speed performance to multiple end points and does its job best when it's handled appropriately. It is not a forgiving material medium and should not be pulled, stretched, and stapled the same way as standard Romex®. A light touch on the installer's part goes a long way towards guaranteeing system integrity and performance.

Leviton recommends the following materials for cable installations:

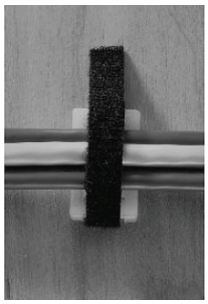
- J-hooks and similar cable supports instead of staples for supporting cable along joists
- Cable clamps on individual cable runs
- VELCRO® tie wraps and cable straps for wrapping multiple cables and for securing cable to studs

Standard staples are not recommended. The methods recommended here are more forgiving. The cost of time spent tracing down and replacing one damaged cable will surpass any lower material expense or labor cost saved by using less expensive staples.



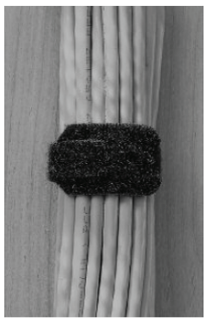
Use j-hooks or similar devices designed to support cables.

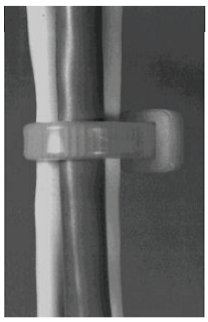
Staple by hand or use staplers with depth stops.

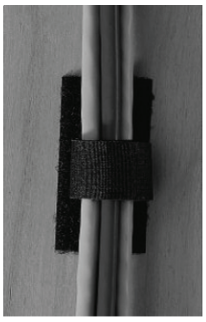


Use VELCRO to keep cables from becoming over cinched.

Use tie wraps loosely on large bundles.







Use VELCRO tie wraps and cable straps to secure bundles.

A single, low-voltage cable running through a stud hole is unlikely to get damaged by a drywall nail or screw, but a bundle of cables would certainly be subject to damage. For the cost of some nailing plates, the nuisance and expense of replacing a damaged low-voltage wire inside a finished wall can be avoided.

It is especially important on vertical runs between wall studs that bundles of low-voltage cable be secured with VELCRO® straps. When in doubt, you can never go wrong adding more support in the form of:

- J-hooks and similar cable supports
- Cable clamps
- VELCRO wraps and straps

Installer Tip:

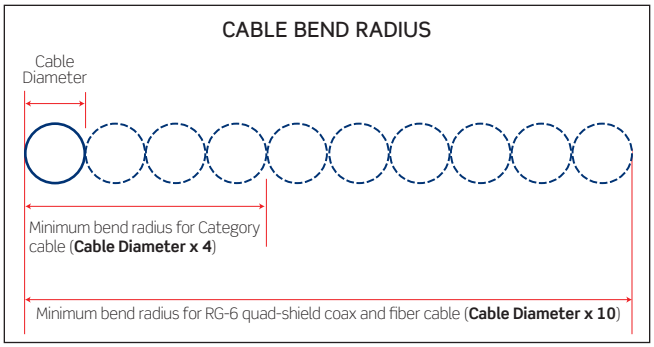
While many requirements for AC cable can apply in low-voltage cable installation, others do not. The FCC calls for the distance between an electrical box and the first strap or staple securing AC cable to not exceed 12 inches. This rule does not apply to low-voltage wiring and in fact would prevent you from leaving a service loop securely tucked inside of a wall.

7.4.3 Cable Bend Radius

Low-voltage cable is not as physically robust as heavier AC cable. 12/2 Romex®, for instance, can be bent at much sharper angles without hindering its performance. ANSI/TIA-570 sets out a very specific bending radius for UTP and coax cable. They state that you should avoid sharp or right angles and make as sweeping a bend as you reasonably can with either of these cables. The cable bend radius for Category-rated cable must not be less than 4x the cable diameter, or about 1 in to 1.2 in. The bend radius for RG-6 quad-shield coax must not be less than 10x the cable diameter, or about three inches. The bend radius for fiber cable must not be less than 10x the cable diameter. These sweeps should be maintained in your cable runs and at termination points.

Don't allow cable to form right angles or sharp bends

Use sweeping bends



Take Note: *When pulling coax or optical fiber cable, maintain a minimum bend radius of 10x the cable diameter, or about three inches.*

7.4.4 Service Loops

Mud ring installation gives the installer access to the stud space. This in turn allows for a service loop or extra cable to be stored in the wall and made available in the event of:

- Damage to the wire at its termination
- A change of devices
- Errors when installing a connector

Leviton recommends:

- A 24-inch minimum service loop for Category Cable, RG-6 quad-shield coax, and speaker wire
- A 36-inch minimum service loop for fiber cable
- Make sure the service loops are larger than the minimum bend radius for each type of cable Category cable: 4x, RG-6, and optical fiber: 10x

7.4.5 Recommended Placements of Cables and Components within the SMC

For the most efficient use of internal space, Leviton recommends the following placements in the SMC:

- Coax cable on the right
- Data and phone in the center
- Audio cable on the left
- AC and DC power modules on the bottom of the enclosure
- Pre-Configured Structured Cabling Panels in the upper section of the enclosure

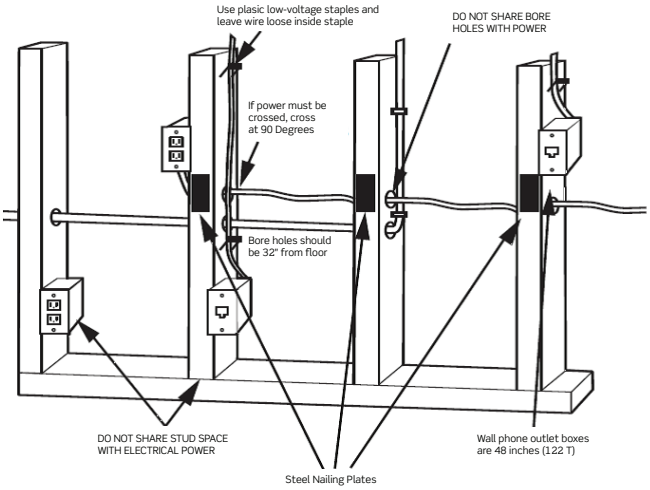
All components should be installed in such a way that cable bends are sweeping and gradual rather than at right angles. Try to employ good cable management practices to avoid twisting and kinking.

7.4.6 Pulling Low-Voltage Wiring Through Wood and Metal Framing Members

Like standard AC cable, low-voltage wiring will run through holes in wall studs, floor joists, and rafters. NEC® guidance for protecting electrical cable applies to AC wiring as well as low voltage electrical structured wiring. This guidance states:

- Cable running through framing members must be 1¼-inch or further from the nearest edge of that framing member
- If a cable cannot meet the 1¼-inch rule, it must be protected by a steel nailing plate attached to the edge of the framing member
- Cable running in intermediate and rigid metal conduit, rigid non-metallic conduit, and electrical metallic tubing is exempt from the 1¼-inch rule
- Cable running through metal framing members must be protected by a bushing or grommet unless the cable is running inside a conduit

A single, low-voltage cable running through a stud hole is unlikely to get damaged by a drywall nail or screw, but a bundle of cables would certainly be subject to damage. For a cost equivalent to some nailing plates, the nuisance and expense of replacing a damaged low-voltage wire inside a finished wall can be avoided.



Installer Tip:
An insulated staple is an ideal fastener for low-voltage wiring. The insulation acts as a built-in stop that prevents the staple from crushing or stressing the cables. Be sure the cable diameter does not exceed the staple's capacity.

Installer Tip:
To ensure optimal performance, keep cables six inches from all speaker and electrical wiring. If AC electrical wiring must be crossed, cross at 90 degrees.

7.4.7 Coaxial/Video Cable on the Right

Video amplifiers and splitters should be mounted on the right side of the Structure Media® enclosure, and their RG-6 quad-shield cables brought in through the right side knockout at the top. This allows for a straight drop for the cables with virtually no bend to them.

➡ **Take Note:** *These cable routing patterns are recommendations. The STRUCTURED MEDIA panels are quite versatile and allow for many different cable routing patterns based on installer preference and STRUCTURED MEDIA Center customization.*

Cable connections at the various modules, panels, and devices in the STRUCTURED MEDIA Center will follow the same principles as corresponding connections at termination points at wallplates. Minimum bend requirements must be met to maintain the integrity of the cables, a minimum of cable jacket removed, and clean wire contact made with a punchdown/termination tool. Following these standard procedures will help assure you of a properly working system.

7.5 Labels

Label all of your cable ends BEFORE pulling them to their termination points. The importance of properly labeling your various low-voltage cables becomes readily apparent during the testing phase. Accurate test results come, in part, from accurate labeling of the cables both at the distribution point in the STRUCTURED MEDIA Center and at the point of termination. The numbers or letters on the cables assure accurate testing (you don't want to discover that the reason the wire is producing an incorrect reading is because it has different labels on each of its ends).

Installer Tip:
You can always install a second label some distance out from the termination point, say six inches, as a back-up. This is especially useful during rough-in work where cable ends might get damaged. Also, you may want to trim the cable during termination.

7.5.1 Labeling

It is critical that low-voltage cable be properly labeled. The last thing an installer wants is to trace an errant connection or incorrectly placed wire because it isn't identified properly. Good labeling will include:

- A master list or index of all cables
- A letter or number system for identification
- A label on both ends of all cables

Installer Tip:
One method for cutting down the confusion of multiple category cables is to use one color of sheathing for the phone system and a second color for data and networking. The cable is all the same, but two different colors (say, blue and gray) make it easier to keep track.

7.5.2 Label Placement

Labels should be placed near the termination point, but far enough from the end to remain readable after termination. Attaching a label to each end of the cable, both at the SMC and behind the wallplates, greatly simplifies identification later. Either write your numbers or letters clearly in permanent ink, or affix pre-printed labels. Letter and number cable identifiers are available from label manufacturers, such as Dymo.

7.5.3 Wiring Chart

Every AC installation comes with at least a rudimentary circuit map attached to the door of the service entrance. Your SMC serves the same purpose as a location for a wiring identification chart for your low-voltage system. This chart (see page 37) should include pathways for:

- Category cables for telephone and voice data distribution
- Coax cable for video distribution
- 16/2 or 14/2 Type CL-II stranded copper wire for speaker wiring
- Other wiring or cable (for example, fiber)

A wiring chart should refer to the rooms or sections of the house where the end-point devices are located in such a way that anyone can identify those areas. Simply to state "Bedroom #1" can be misleading to a future homeowner or technician. The chart should employ more accurate directions, such as "2nd-floor NW bedroom," to avoid confusion.

Installer Tip:
For an even more foolproof identification, duplicate labels can be placed on the inside of the wallplate.

7.6 Pre-Wire for Individual Devices

Each end-point device calls for its own wiring requirements, such as cable type and location. The following summarizes these requirements:

- Run Category cable to every data and phone jack
- Run RG-6 quad-shield coax cable to every TV/video outlet
- Run Category Cable and RG-6 quad shield cable (if specified) to every indoor camera location
- Run additional RG-6 quad-shield and category cable to any location where multi-room audio/video is planned

➡ **Take Note:** *You may have a higher cable count than needed for the number of connection points in the SMC. This approach enables future expansion and can save much time and expense in the long run.*

Installer Tip:
Common applications use speaker wire or twisted pair. Running both during installation will allow for easy upgrades or changes in the future.

7.7 What You Need to Know

- Unless they are in violation of your local codes, use mud rings instead of electrical boxes for mounting devices, wallplates, and terminating the cables
- Choose a centrally located, dry, well-lit room for installing the Leviton STRUCTURED MEDIA™ enclosure
- The enclosure is intended for low-voltage distribution only; any AC power needed for distribution modules is to be supplied by a Leviton AC Power Module
- It is important that all low-voltage cable be properly labeled on both ends of the cable as well as on a wiring chart inside the STRUCTURED MEDIA enclosure, even if that cable is for future expansion and not yet connected

7.7.1 Standard General Practices

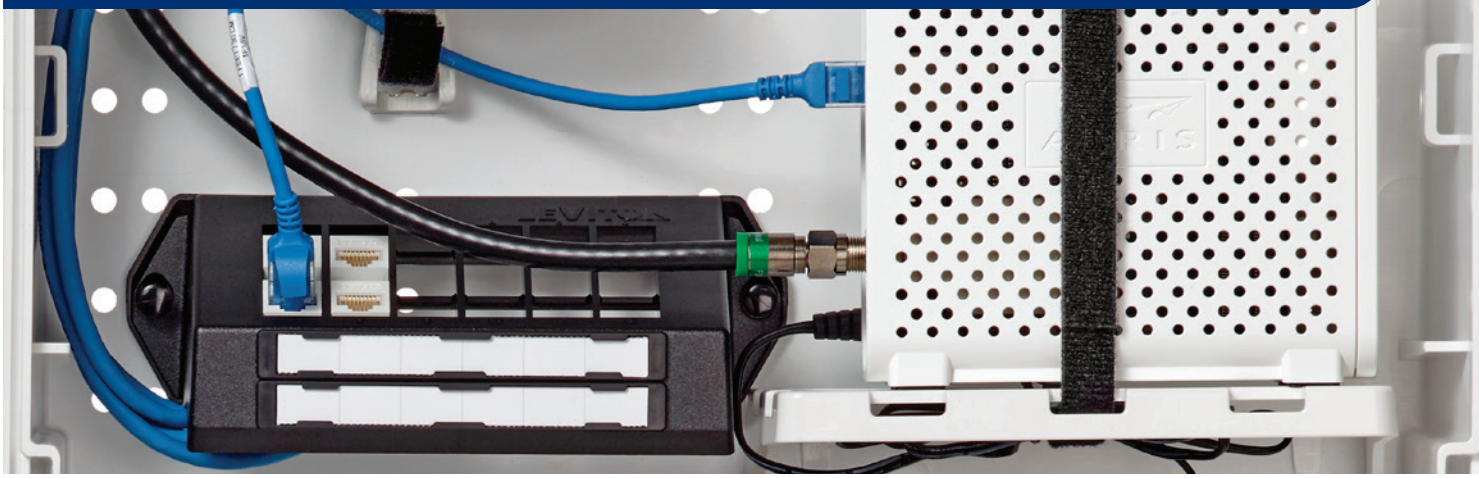
- Always use a STRUCTURED MEDIA enclosure as your main distribution point
- Do not install the STRUCTURED MEDIA enclosure in a fire-rated wall; choose interior wall spaces
- Install your structured cabling following the star-wiring or home-run pattern
- Use tools made specifically for low-voltage structured cable installation
- Observe the maximum distance rule that limits a category cable run from the SMC to a wallplate to 90 meters or 295 feet
- Inspect your runs as you install them

7.7.2 Wire and Cable Installation

- Low-voltage wiring is not as damage resistant as Romex®, so be sure to handle it carefully
- Drill independent 1-inch holes 1¼ inches from the edge of framing members to run your cable; never run low-voltage cable in the same drill holes as AC wiring
- Use nail plates to protect the cable
- Avoid damage to twisted pairs by using less than 25 pounds of pull force, and by only going around one bend at a time
- Make sure to use proper bend radius per manufacturer's guidelines; for optimal cable performance use sweeping bends in installation
- Secure large bundles of cable loosely with VELCRO® straps, secure smaller bundles with tie-wraps
- Always use proper cable support, such as J-hooks and VELCRO straps, never with standard staples
- Run your low-voltage cable separate from AC cable by using a separate stud space whenever possible; otherwise, maintain at least a 12-inch distance (more is better) when running parallel to AC and if you must cross it, do so at a 90-degree angle
- When running your cable in conduit, leave a pull cord to facilitate new wiring (do not exceed a 40% fill rate)
- Install your cables inside inner-wall spaces to avoid outer -wall insulation and firebreaks
- Keep your cable away from sources of heat such as hot water pipes and heat ducts
- Avoid running external wires; if you must, install them in a conduit

7.7.3 In Summary

Leviton wants your installations to be successful and error-free. Like AC installations, low-voltage wiring has its own guidelines and standards. By following them, you will ensure the installation works from the start, and any future upgrades will go smoothly.



Installation Trim Out

At this point, you have familiarized yourself with the STRUCTURED MEDIA™ enclosure (or distribution center) and the routing and installation of low-voltage cable. This section will deal with the installation of distribution modules, end-point devices, connectors, and other components of structured cabling.

8.1 QUICKPORT™ Connectors and Wallplates

The foundation of the Leviton Connected Home installation is its distribution centers and the cable itself, but the system is just as dependent on its smaller hardware components. These include:

- QUICKPORT Snap-In Modules and connectors
- QUICKPORT Wallplates

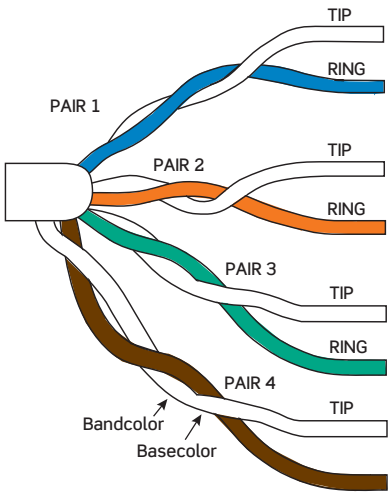
Cable terminations at connectors, modules, and Cat 5e, Cat 6, or Cat 6A connectors are critical to the integrity of your structured cable installation. The next four sections describe terminations at wallplates.

Category Cable Primer

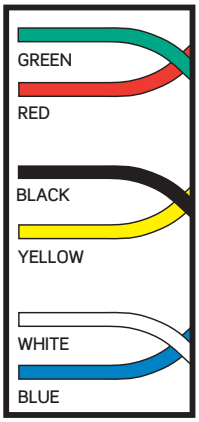
Each twisted pair must attach to its own color-coded location on the eight positions of a category rated connector. Standard 4-pair UTP color coding uses five colors in a distinctive combination. The color combination identifies the pair number (1 through 4) as well as the first or tip wire and the ring wire within the pair.

Low-voltage cable is typically 22-24 gauge. It must be handled carefully in order for it to carry a signal with the least amount of loss or distortion. The installer should use the tools and methods recommended in this manual in order to maintain the integrity of the system.

A. Category rated Twisted-Pair Wire



B. Solid-Color Twisted-Pair Wire
(obsolete but may still be found in existing installations)



T568A & T568B WIRING STANDARDS IDC COLOR ASSIGNMENTS		
CONNECTOR PIN #	T568A WIRE COLORS	T568B WIRE COLORS
1	White/Green	White/Orange
2	Green	Orange
3	White/Orange	White/Green
4	Blue	Blue
5	White/Blue	White/Blue
6	Orange	Green
7	White/Brown	White/Brown
8	Brown	Brown

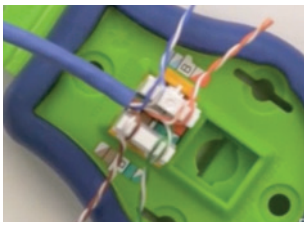
8.1.1 Terminating Category Rated Connectors

All voice and data category cable is terminated in a category rated conector with 110 insulation-displacement contacts (IDC) using the T568A or T568B wiring pattern per local practice. ANSI/TIA 570 recommends the use of 8-conductor Category Rated connectors only. To terminate a cable at a category rated connector:

What You'll Need:

- UTP Stripping Tool
- 110 Punchdown Tool
- Leviton Palm Termination Tool with Jack Holder

1. Allow a 24-inch service loop at the wallplate
2. The jacket must touch the connector when cabling (Normally 1½ to 2 inches of cable jacket is removed when terminating the connector)
3. Use a Leviton UTP Stripping Tool (or equivalent) to strip the jacket
4. Follow the color code, matching up like colored wires to their counterpart's locations on the connector.Select the T568A or T568B wiring pattern per local residential practice and use throughout the installation
5. Maintain pair twist as close as reasonable to the point of termination. The standards allow for up to ½ inch (13 mm) of untwist
6. Use a Leviton 110 Punchdown/Termination Tool (or equivalent) for inserting the cable into the connector and trimming off the ends, one wire at a time, one pair at a time, starting at the rear of the connectors with the blue pair

Installer Tip:

The Leviton palm termination tool for holding connectors during punchdown provides a flat, level surface for punching down cable and cutting off the ends on the connectors. The tool fits in your pocket and is readily available when you don't have a convenient work surface.

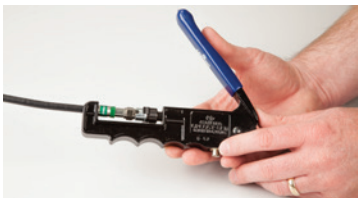
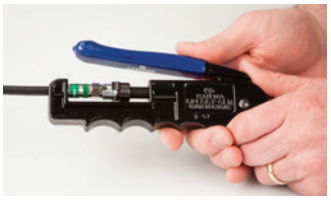
8.1.2 Terminating F-Type Connectors

1. Cut the cable to allow for adequate service loop (24 inches at wallplate locations). Use a RG-6 quad-shield cable stripper, properly adjusted, to strip off the correct amount of cable sheath, shields, and foam insulation. The exposed wire core should be about ⅜ of an inch in length. The exposed shield should be ¼ of an inch in length
2. Fold the outside braided shield evenly back along the cable sheath and insert the connector onto the cable end
3. For compression fit connectors, make sure the foam core seats flush against the inside end of the connector (You can see the foam core position by looking in the threaded end of the connector)
4. Place the connector and cable into the compression tool, and actuate the tool to install the connector onto the cable
5. Check to make sure the center conductor is straight and extends ⅛ of an inch beyond the threaded end of the connector
6. For crimp style connectors, make sure the foam core seats flush against the inside end of the connector. You can see the foam core position by looking in the threaded end of the connector
7. Place the connector into the crimp tool at the proper position according to tool instructions, and crimp the connector onto the cable
8. Check to make sure the center conductor is straight and extends ⅛ inch beyond the threaded end of the connector

What You'll Need:

- RG-6 Quad-Shield Compression or Crimp Connectors
- RG-6 Quad-Shield Stripping Tool
- RG-6 Quad-Shield Compression or Crimping Tool depending on type of connectors. Leviton recommends using compression compatible tool.




8.1.3 Terminating Other Connectors

Low-voltage cable can also be terminated at one of the following connectors:

Terminating RCA connectors on 40735-Rxx

1. Remove approximately two inches of cable jacket from cable
2. Note the color-coded label located between the connector slots, including pin numbers
3. Route the wires for termination. Terminate one pair at a time, placing cable so that the jacket touches the connector's edge. Start from the side of cable entry. Terminating each pair after placement will prevent crushing the inside pairs with the punchdown tool
4. Using a 110-style impact tool (set to low), seat the wires into the IDC slots. Maintain wire pair twisting as close as possible to the IDC contact. Must be ½ inch or less
5. Place the cap over the terminated wires for secure connection and added strain relief
6. Insert connector assembly into platform or wallplate. Note the "UP" position of the connector

Terminating Speaker binding posts and banana jacks

1. Remove approximately two inches of outer cable jacket
2. Remove ⅜ of an inch of insulation from one of the wires
3. Twist the strands together to prevent fraying
4. Back set screw out of rear of connector
5. Insert wire into back of connector so that the insulation is flush with the rear of the connector
6. Tighten set screw and give a tug on the wire to make sure it is secure

8.1.4 Placing QUICKPORT™ Connectors into QUICKPORT Wallplates

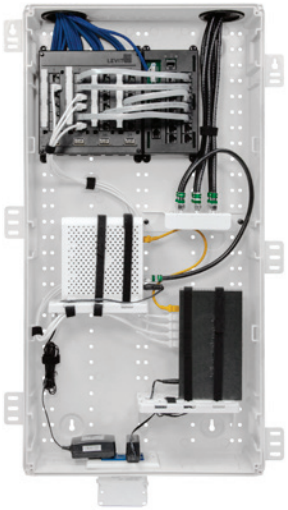
Leviton makes installing connectors at wallplate locations a simple and an easy operation. To install QUICKPORT Connectors into the QUICKPORT Wallplates:

- Match "UP" on the wallplate to "UP" marked on the connector
- Seat the lower catch on the connector into the wallplate retention feature
- Roll the connector into place until the latch snaps in place

8.2 STRUCTURED MEDIA™ Center Devices (SMC Trim Out)

The installation of devices in the STRUCTURED MEDIA enclosure will take place after the drywall taping and painting have been completed. The various modules, Pre-Configured Structured Cabling Panels, and other devices are designed to fit neatly and securely inside the STRUCTURED MEDIA enclosures.

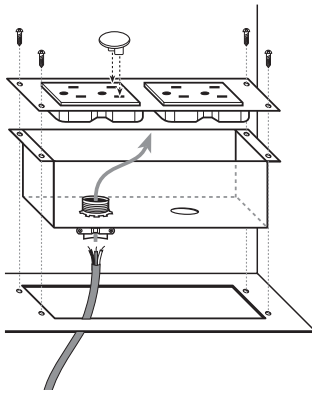
8.2.1 Placing and Mounting Devices



Most devices will be installed horizontally, but the SMCs are designed to accommodate vertical installation as well. Your choice of devices will determine how they are mounted inside the SMC. Follow these guidelines when installing these devices:

- Install the most cable-intense components at the top of the SMC
- Placement of devices should allow for easy looping of cables to avoid sharp angles and to maintain the minimum bend radius mentioned in Chapter 6
- Always install the AC Power Module at the bottom of the SMC
- Spending extra time organizing and wiring the SMC is time well spent, as future moves, adds, and changes will be easier

Your most cable-intensive installation will be an SMC with multiple application modules.

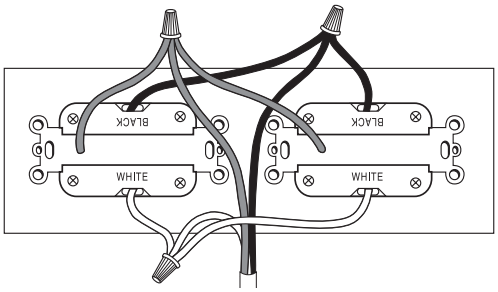


8.2.2 Installing the Power Module

The above diagram shows the installation of a Leviton AC Power Module:

1. Remove the large, rectangular knockout at the bottom of the STRUCTURED MEDIA enclosure
2. Punch out one or both of the cable-entry knockouts that are located at the bottom of the power module housing and pull your cable(s) through
3. Feed electrical cable through the power-module mounting
4. Secure your electrical cable with a standard conduit fitting or cable clamp (not included)
5. Drop the housing into its opening

Next, connect the incoming power cable to the surge suppressor receptacles. The wiring connections will depend on whether one or two dedicated circuits are being run to the Power Module. The diagram below shows the installation of the receptacles using the single cable of one dedicated circuit:



1. Attach a pigtail or short piece of white "neutral" (N) conductor to the silver terminal screws on each receptacle. These screws are located on the sections labeled "white" on the back of the receptacles
2. Twist the two white pigtails together with the white or "neutral" conductor from the incoming power cable, securing the ends with an appropriate wire connector
3. Attach a black or "hot" pigtail to each brass-colored terminal screw on the back of each receptacle (These screws are located on the sections labeled "black" on the back of the receptacles)
4. Twist the two black pigtails together with the black ("hot") conductor from the incoming power cable, securing the ends with an appropriate wire connector
5. Twist the green ground leads from the receptacles with the green or "bare" copper grounding conductor from the incoming power cable, securing the ends of the wires with an appropriate wire connector
6. Carefully place the receptacles into the housing, being sure that all wiring is safely tucked inside
7. Secure the Power Module to the STRUCTURED MEDIA™ enclosure using the four #6x⅜-inch screws that come with the module, tightening the module securely; these screws also secure the module's housing to the SMC
8. Test the module by turning the power to its dedicated circuit(s) on, at the service panel
9. Until the work is completed, install safety plugs into the receptacles to protect them from construction debris

If you're installing two separate dedicated circuits, each incoming cable will connect directly to a single receptacle without the use of pigtails or wire connectors.

8.2.3 Routing and Dressing Cable in the STRUCTURED MEDIA Enclosure

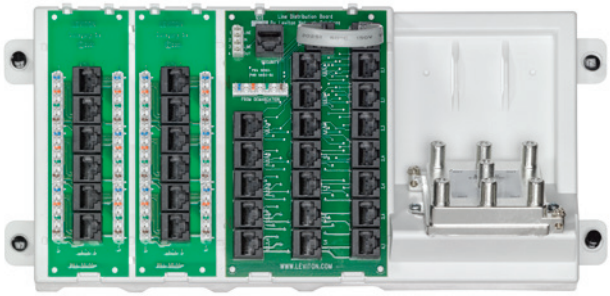
Make sure to maintain an appropriate bend radius for all cables in the STRUCTURED MEDIA enclosure, per the instructions in paragraph 7.4.3. It's easier to keep track of the cables in a STRUCTURED MEDIA enclosure and establish a consistent installation pattern if you follow one design. Sometimes, such as in the case of add-ons after the completion of a job, you might have to deviate from this design, but a new service offers an opportunity for a clean installation based on Leviton's recommendations.

8.3 Residential Infrastructure

The Residential Platform serves networking and its multitude of devices as well as multi-room audio and video requirements.

8.3.1 Telephone Connections Using Telephone Distribution and Cat 5e or Cat 6 Voice & Data Modules

Leviton offers two components for superior voice and data connections in its residential platform as part of the Advanced Home Office and Video Panel:



6. The Telephone Distribution Module distributes up to four (4) lines of service throughout a home or office. This module does not stand alone, but connects to the selected Cat 5e, 6, or 6A Voice and Data Module or Patch Panel with patch cords for easy changes. The Telephone Distribution Module acts as the initial connecting point for incoming phone lines. The upper test jack can be used to test the incoming dial tone for all incoming lines.
7. The Cat 5e, Cat 6, or Cat 6A Voice/Data Module or Patch Panel is used to add modular voice/data distribution. It can be used as a stand-alone distribution device for data (when used with user provided router or switch gear), or to distribute voice over Category cables to locations throughout the home.

   Various module port counts are available supporting category cables; each terminates on the Industry Standard 4-pair 110 IDC Connectors included with the selected module.

To configure the connections for voice (with a Telephone Distribution Board), simply connect a 8-position, 8 conductor flat telephone patch cord from a port on the Telco Distribution Board to the port on the Voice/Data Module that you wish to activate. The jacks on the voice/data module are designed to accommodate 6-position, 4-conductor telephone cords as well as 8-position, 8-conductor cords.

Installer Tip:

It's worth repeating — to avoid removing too much of the jacket from the first (blue) or last (brown) wires, install either the orange (#2) or green (#3) wire first at the punch down block. This helps to center the cable. Otherwise, if the blue pair is installed first and terminated close to the cable, the brown pair will extend further than the one-half inch from the jacket and therefore be more exposed than the standard calls for. Remember, the more exposure, the greater the chance for a substandard installation.

8.4 Multi-Location Networking Application

To configure your connections for data, identify the cable you wish to activate and connect one end of a category rated patch cord into the corresponding jack and the other end into a port of an installed switch or Internet router.

To support more ports, larger network switches may be used or multiple switches chained together. Refer to switch documentation for limitations. If a router is used, use the ports on the router to connect multiple switches (i.e. port one on the router goes to the first switch and port two goes to the second).

8.5 Video Distribution (Coax)

There are many possible variations of coax video distribution using Leviton STRUCTURED MEDIA™ components. The three basic types used in residential work are the following:

- Passive distribution using a 6- or 8-way passive splitter
- Hybrid distribution combining a passive splitter with a dedicated Video Amplifier (supplied by others)
- Active distribution using the Premium Video module

Passive Distribution with the 6- or 8-way Splitter

The simplest distribution method is passive distribution. It is a satisfactory solution for distributing coax cable TV to multiple rooms in a single-family home. Leviton splitters come with six or eight outputs to correspond to the number of video locations covered in your installation. The 6-way splitter, which is included with the Advanced Home Office Panel, is designed to meet the majority of video distribution needs, for example:

- Two separate wallplate locations in the living room
- One location in the kitchen
- One location in each of the three bedrooms

Alternately passive splitters are available separately in 1x6 or 1x8 configurations and optionally include a convenient mounting bracket. To install with the mounting bracket:

1. Line up the module's pins with the mounting holes in the STRUCTURED MEDIA™ enclosure (the module can be mounted horizontally or vertically)
2. When set in the desired location, push the pin plungers to secure the module to the STRUCTURED MEDIA enclosure
3. Route your RG-6 quad-shield coax cable into the STRUCTURED MEDIA enclosure, avoiding sharp or abrupt bends in the cable; install a male F-type connector at the end of each cable
4. The video input (from your cable TV or antenna, for example) goes into the center connector (marked "IN") on the splitter
5. Attach your cables for each video location to the connectors on the splitter marked "OUT"
6. Cap any unused outputs with a 75-ohm terminator

Installer Tip:

If you have run extra RG-6 cable through the home, it is a good idea to spec in enough splitter capacity and coax to handle an additional two TV locations more than the actual number of terminations required, in order to allow for future expansion. If doing so, follow the same rule on any video splitter and cap all unused F-connectors with Leviton 75-ohm terminators.

Hybrid Video Distribution

The typical cable signal coming into a home is usually sufficient to provide a clear signal to the end device, cable set top box or digital receiver. In some cases, the signal might need amplification. There are three things that affect the signal level in the home:

- The level of the signal from the CATV provider at the demarcation point
- The number of coax runs (from the splitter or number of splits)
- The length of the coax cable runs

Generally sufficient signal levels are provided by the service provider to support 6 or 8 total device splits and the typical installed Coaxial cabling length. In th event of signal issues which cause video or network instability consider the addition of a standalone video amplifier placed on the incoming service feed or the use of an Active Coaxial Splitter solution.

➡ **Take Note:** *An uncapped connector can provide an open video circuit that can cause extra noise to plague the system. Do not use terminators on satellite distribution system.*

Active Distribution with the 1x8 and 1x16 Active Modules
Active Distribution with Leviton Active CATV Modules are designed to distribute incoming RF signals (Cable TV, HDTV, Antenna, or other modulated sources) to 8 or 16 locations throughout a home or office on coax cable. The modules incorporate state-of-the-art signaling to support Coaxial Cable and Antenna applications up to 1000 MHz. The active line optimizes the performance of digital cable signals to handle advanced technologies offered by cable operators, including delivery of HDTV. (note: not for use with systems that employ MoCA® signaling)

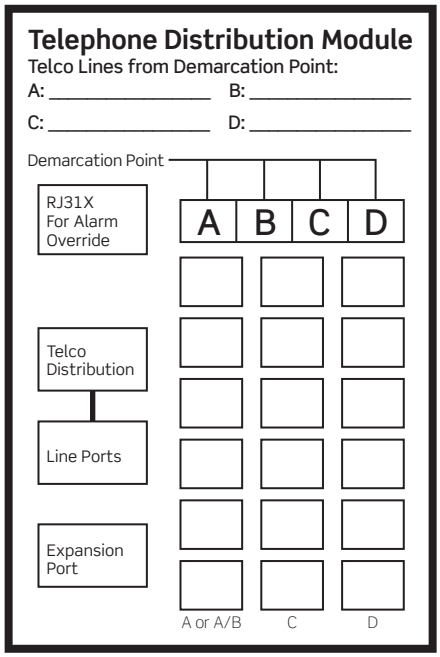
To install the 1x8 or 1x16 Premium Modules:

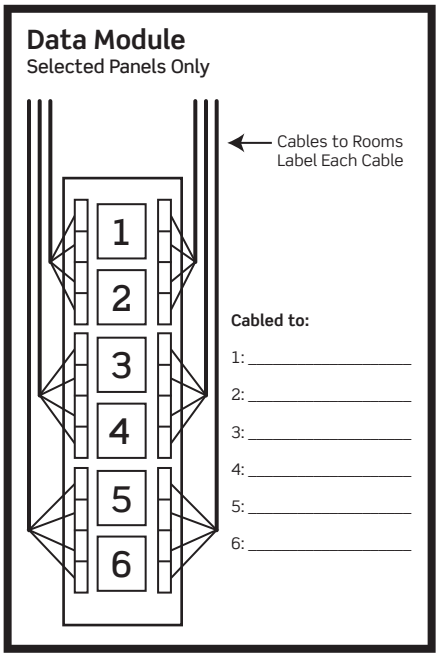
- Line up the module's pins with the mounting holes in the STRUCTURED MEDIA enclosure (the module can be mounted horizontally or vertically)

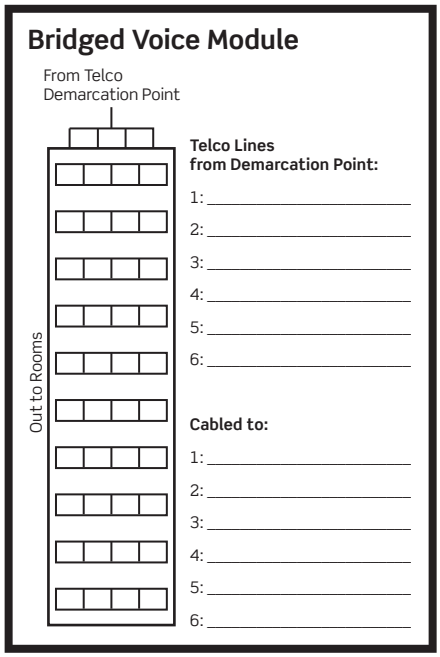
- When set in the desired location, push the pin plungers to secure the module to the STRUCTURED MEDIA enclosure
- Route your RG-6 quad-shield coax cable into the SMC, avoiding sharp or abrupt bends in the cable; install a male F-type connector at the end of each cable
- The video input (from your cable TV or antenna, for example) goes into the connector marked "IN" on the splitter
- Attach your cables for each video location to the connectors on the splitter marked "OUT"
- Cap any unused outputs with a 75-ohm terminator

Installer Tip:

Check with your CATV provider to determine the signal level at the house demarcation point. The input signal level from the CATV provider or local antenna will be between 0 dBmv and 15 dBmv. The lower end of that range may require a video amplifier. At the high end of the range, you might have sufficient signal to make a video amplifier unnecessary for up to eight video terminations. Beyond eight video terminations, you will likely need a video amplifier.







8.6 Wire and Cable Installation

Telephone Distribution Module:

1. Run cable into enclosure from telephone demarcation point
2. Punch pairs down using industry-standard 110 tool; (A) wht/bl – blue pair/line one; (B) wht/or - orange pair/line two; (C)wht/gr - green pair/line three; (D) wht/br - brown pair/line four (Note: Some regions may use the T568B wiring pattern which would put the Green Pair on line 2 and the Orange pair on line 3. Verify local practice and match)
3. All three columns are now active with dial tone; use patch cords to link whichever line you need to the outgoing port on the Voice/Data Module

Voice/Data Module:

1. Run cable into enclosure from telephone demarcation point
2. Terminate (by punching pairs down with an industry-standard 110 tool) individual outlet cables, one per connector. Label cables to identify locations they run to. Use “Cabled to” section to identify which port corresponds to which cable
3. Use patch cords to link the ports to the Telephone Distribution Module or to a network router or switch equipment

Bridged Voice Module:

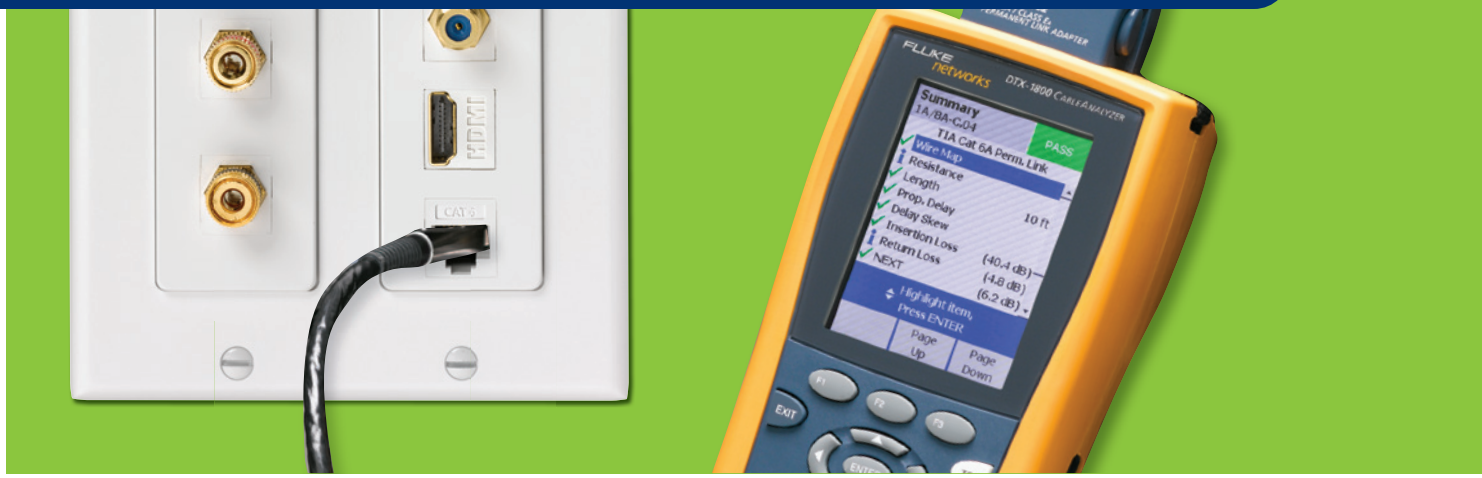
1. Run cable into enclosure from telephone demarcation point
2. Punch pairs down using industry-standard 110 tool starting with the blue pair/line one
3. Telco line is then bridged on the matching color only to all remaining connectors on the module
4. Terminate individual outlet cables, one per connector, on lower nine bridged connectors. Label cables to identify locations they run to. Use “Cabled to” area for additional cable identification

Wiring Identification Chart For Category Cables:

Instructions: Label every cable that enters the enclosure and record in the following chart. The reason to do this is that the cables are a structured part of the house and will not be moved. Components are not structured, may be changed, re-cabled, disconnected, etc., and should not be used to identify functioning of cables.

Label:	Location:	Label:	Location:
V1	Family Room South Wall RG6	T18	Master Bedroom West Wall Cat 5 or 5e

9. Documentation, Testing, and Troubleshooting



Documentation and Testing

Low-voltage cable is not as durable as other types of cable, and it has been specifically designed to meet strict requirements. Low-voltage cable follows its own industry standard and requires specific tools and care to maintain the integrity of a structured wiring system. It is more easily damaged during rough-in and drywall installation than other electrical cable, and damage can go unnoticed. For these reasons, it's important that low-voltage cable is tested thoroughly. Testing verifies that no faults occurred during the installation; problems occurring later will be due to other reasons such as system abuse or damage from individuals, other than the installer.

9.1 Documentation

All testing can be recorded and documented. Leviton supplies cable test documentation forms at the end of this chapter.

9.2 Visual Inspection Immediately after Pre-wire

Complete a thorough visual inspection of all cables and check for the following:

- All cables are labeled on both ends for easy identification
- Obvious damage to the cable
- Incorrect bend radius (minimum of four times the cable diameter for Category cable and 10 times the cable diameter for RG-6 quad-shield cables)
- Wire color matching to assure the right access line is assigned to the right pair
- For speaker wire (+ and -) assigned to the proper pins

9.3 Basic Testing

A normal AC device load that trips a circuit breaker alerts an electrician that there's a problem in the circuit. Problems with low-voltage wiring installations do not always show up as readily as those with AC cable. Testing is critical to confirm that the system is working properly.

You may be performing your tests before any dial tone is available from the telephone service provider, or signal is available from the CATV service provider, or a TV or DSS antenna has been installed. Therefore, the testing described below assumes that no signal or attached consumer electronics equipment is available.

In basic testing, you will be testing the cables for the following:

OPEN: Also known as an open fault. This means that the circuit is not complete or the cable/fiber is broken.

SHORT: An incomplete circuit caused by a hot conductor coming into contact with a ground or metal component; the current does not follow its intended path.

CROSS: The occurrence of a short between two terminals; usually occurs when too much bare copper conductor is stripped and then the end is not trimmed after connection.

SPLIT: This occurs when two wires of a pair are split or separated and improperly matched with wires from another pair.

REVERSED POLARITY OR ROLLS: A rolled pair results when the tip and ring leads are reversed in connecting to the network.

FINAL VERIFICATION: Performed with either a buttset or a telephone set once dial tone is installed and all initial testing completed.

WARNING: Do not do any testing on energized wiring or circuits. Disconnect all sources of electric current before starting your tests. Be sure that all distribution panels and modules are disconnected from either the AC or DC modules.

Basic testing does not cover network performance testing, but can be used for the following:

- Inbound cable from the telephone service provider demarcation point
- Category cable used for powering video cameras or IR targets and IR emitters
- Category cable for telephones that terminate on the 1x9 Bridged Telephone Module
- Audio cable (for speakers and volume controls)
- RG-6 quad-shield cable

To perform your basic tests, you'll need the testing tools listed below:

- Multimeter or Volt-Ohm meter
- Category Cable Field Tester Level II compliant
- Cable Tester for coax and other cable
- Modular Plug Breakout Adapter
- Tone Test Set
- Inductive Probe
- Craftsperson's Handset (buttset)

All tests should be recorded and documented.

Installer Tip:
During rough-in, continually do visual inspections for damaged cables. Look for the most obvious problems before spending too much time doing instrument testing.

9.3.1 Cat 5e or Cat 6 in Non-Network Applications

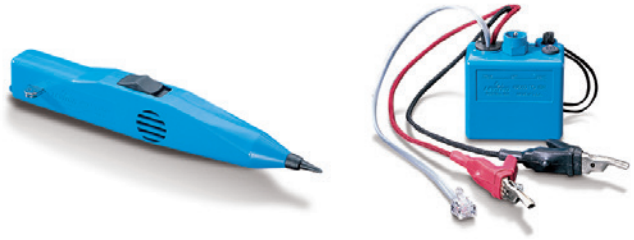
Cat 5e or Cat 6 cable that terminates on the 1x9 Bridged Telephone Module in the SMC may be tested for continuity in two ways. In the first and preferred method, you will use a Cat 5e or Cat 6 field tester. Plug the remote tester into a Cat 5e or Cat 6 connector at any wallplate. Plug the handheld tester into another connector connected to a cable that also terminates in the 1x9 module. Run the Wire Map test on the Cat 5e or Cat 6 tester handheld unit.

This test will indicate any splits, rolls, continuity, or shorts in between the handheld and remote tester, through the 1x9 Bridged Telephone Module. Leave the remote where it is, and move the handheld unit to plug into all connectors connected via cable to the 1x9 Bridged Telephone Module. All cable runs must pass the test. If any cable run fails or all runs fail, verify that all punchdowns at the connector are correct and follow the T568A or T568B wiring configuration chosen. Then verify all punchdowns are correct at the 1x9 Bridged Telephone Module. If all punchdowns look correct, disconnect one cable at a time from the 1x9 Bridged Telephone Module punchdown IDC, and retest at a connector terminated on a cable that remains connected to the 1x9 Bridged Telephone Module until the trouble is found and corrected.

You can use a tester similar to the FLUKE MICROSCANNER PRO™ to detect miswires, location, and run lengths for the Category cable that does not terminate at both ends on category-rated connectors, RG-6 quad-shield cable, speaker wiring, or alarm wiring. The tester can find pair polarity (wire map), excessive length, shorts, opens, and other problems in your cable runs. It can also help you determine if your cable labeling is correct by enabling you to locate which cables terminate in various rooms.

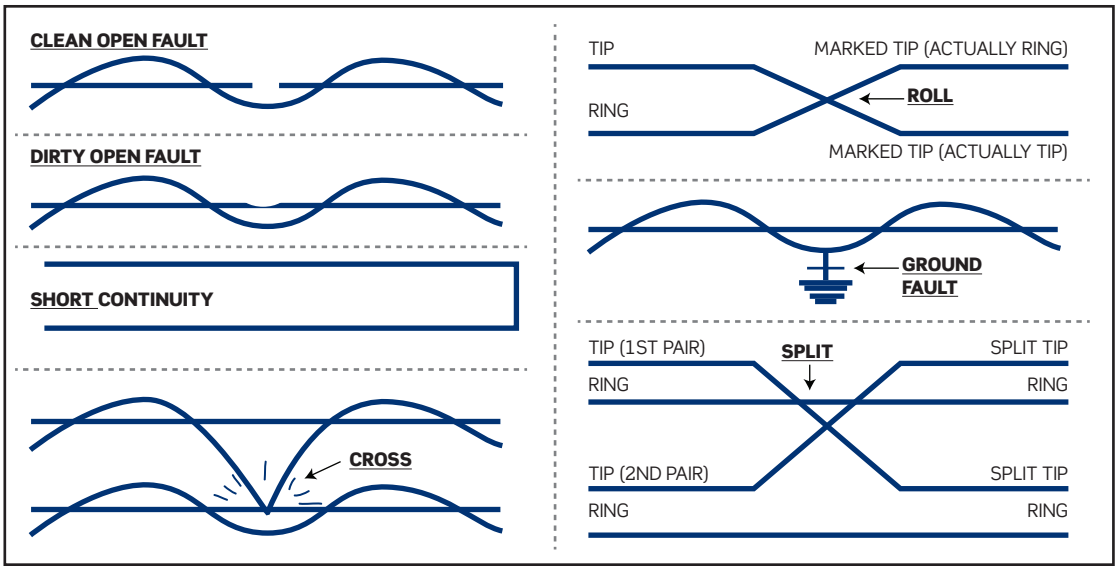
Please follow the directions included with these testers to check your wiring and solve any problems that may exist.

Another testing method using a Modular Plug Breakout Adapter tests any 6- or 8-position modular jack (and can be used in series) while using a Tone Test Set or the Craftperson's Handset. Alligator clips connect the contacts to any test apparatus or to a Lineman's Test Set. These test tools allow you to test that any given pair terminates at the correct position on the jack. These tools can be especially useful when terminating more than one phone line (up to four different phone numbers) on jacks throughout the dwelling.



Should the various cable runs not pass the test, you can use the Inductive Speaker Probe, used in combination with the Tone Test Set, to detect audible frequency tones so wires, cables, and metallic circuits can be traced and identified without damage to their insulation. The Inductive Speaker Probe's duckbill and needlepoint tips provide great flexibility for inspecting wiring in tight spots, cables under tension, or larger cable bundles. In noisy environments, a buttset can be attached to the probe's connecting tabs (Note: never place the point of a inductive probe into a jack port it may damage pins within the jack).

Common Wiring Faults



9.3.2 Audio Cable

For installed speaker cable there are really only two tests, looking for shorts and looking for opens. Set your digital multimeter to the continuity or alarm setting and place the probes on the black and red wires on one end of the speaker cable (nothing should be attached at the other end for this test). You should not hear the alarm; if you do then there is a short between the wires. Look at the terminations first for loose strands of copper that may be touching the other wire. If all is well at the ends and you still have a short, new cable will need to be pulled.

To test for opens attach a single piece of wire between the red and black wires at one end. At the other end place the multimeter probes on the black and red wires. You should now hear the alarm. If you don't, there is an open somewhere in your cable and a new one will need to be pulled.

9.3.3 RG-6 Quad Shield Coax Cable

For RG-6 quad-shield cable runs, use the Microscanner to determine shorts, continuity, termination location (for checking labeling), and length of cable. As an alternative for unterminated RG-6 quad-shield cable, use a multimeter or volt-ohm meter to check the resistance between the shield and center conductor on RG-6 quad-shield cable. If the meter shows a finite resistance reading (below 100 K-Ohms), then the cable has a short and that cable run fails the test.

For RG-6 coax that is terminated in a Leviton CATV splitter, or in a run with a 75 Ohm termination cap, the resistance measurement should be near 75 Ohms to pass the test.

Cable Testers - Manufacturer Listing

The following companies manufacture handheld cable testers. This information is listed as a courtesy for your reference only and is not an endorsement nor a recommendation. You are advised to contact each company directly to request detailed information about their products. Some of these companies also sell their products through other companies under other product names; you are advised to ask which of these companies is the actual manufacturer of the tester.

Softing IT Networks

7209 Chapman Hwy
Knoxville TN 37920, USA

Customer Service:
1-865-251-5252
sales@softing.us

itnetworks.softing.com/us/

Fluke Corporation

6920 Seaway Boulevard
Everett, WA 98203
United States

Customer Service:
1-800-283-5853

flukenetworks.com

TREND NETWORKS

300 Roundhill Drive, Suite 1,
Rockaway, NJ 07866, USA

Customer Service:
1-877-390-6161
contactus@trend-networks.com

trend-networks.com

9.4 Network Certification Testing

A measurement must be done for one of the following:

- Permanent Link
- Channel

A Permanent Link is the permanent part of the cable run. It can be up to 295 feet (90 meters) long from the SMC to the termination point.

A channel (or user model) includes the patching or equipment cords after they are added onto the link. The total allowable length for a channel is approximately 328 feet (100 meters). The equipment cords, patch cords, and jumpers cannot exceed 33 feet (10 meters) in total length.

For field testing Category cable, your test instruments must meet or exceed the applicable requirements in ANSI/TIA-568. Commercially available instruments will specify whether they meet level accuracy. You will want to use those that meet Level III or IV. To meet ANSI/TIA-568 standards, the network performance testers must be able to perform the aforementioned tests for length, for all pairs of an installed link, attenuation, and Near-End Crosstalk (NEXT). Testers may also measure for delay on an installed link (the time it takes for a signal to travel from one point to another).

Test Rules for Category Cable

- Cabling and components cannot be moved during testing
- Both pass/fail indications and the actual measured values (frequencies) should be recorded
- Reconfiguration might require re-testing
- Test manufacturer Permanent Link Test Cords should be used to attach the test instruments to the link under inspection
- If you make a channel test, the end-user patch cords must be tested in place
- The field tester must meet ANSI/TIA-568 Level III or IV accuracy requirements

➡ **Take Note:** *Your networking performance test equipment requires you to plug in at both the SMC module and the wallplate jack on the same link to perform the auto test routines. You will need to enter the cable number and then record the test result, Pass or Fail, as displayed on your tester.*

Most testers will record the pass/fail information internally and then allow you to download the information to a PC file. Follow the instructions that come with your network field tester to record and download test information.

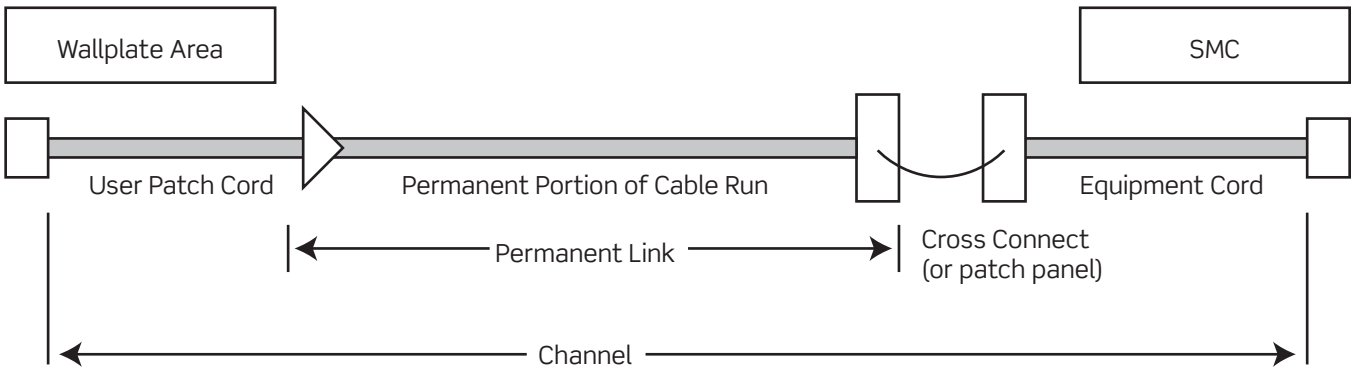
9.5 Documentation of Test Results

As we've mentioned, you should record your results as you complete each test. Use the forms provided at the end of this chapter to write in your results by hand, or, if using a network performance tester, use the built-in database for recording your data.

Note: The cable name or number from the label on the cable must be entered into the tester or the form to coincide with the test on that cable run.

Record the results of the test as pass or fail, with a print out and/or by checking the appropriate column opposite the cable run under test. There may also be special circumstances you want to record, such as a short, break, miswire, or some other condition in the "Notes" column.

The test forms and/or files from the tester are valuable information and prove you have completed your installation satisfactorily.



"Permanent Link" Test Configuration	"Channel" Test Configuration
- Covers just the permanent portion of cable run - Intended primarily for cable installers who must test cable before patch cords and network equpiment are installed	- Measures end-to-end cable run performance - Includes the user patch-cords at both ends that will be left in place following the testing

Test Documentation Form

			Test Results				
Cable Number	SMC Termination	Wallplate Location	Shorts		Continuity		Notes
			Pass	Fail	Pass	Fail	
Installer Signature: _____							Date: _____

10. Warranty

Leviton Quality and Warranty

Leviton Network Solutions produces the highest quality products available and backs them up with one of the strongest warranties in the industry.

A

Amplifier A component that boosts the strength of a transmitted analog signal as measured in decibels (dB); an amplifier is similar to a repeater in digital systems.

Analog A method of transmitting information by a continuously variable electrical signal.

Attenuation The decrease in the power of a signal, light beam, or light wave as they pass through a transmission medium. Measured in decibels, attenuation is the opposite of gain. Attenuation often increases with frequency, cable length, and the number of connections in a circuit.

Architecture The way that a system (hardware, software, and the network) is structured and its components fit together.

AWG (American Wire Gauge) Standard measuring gauge for non-ferrous conductors (i.e. non-iron and non-steel). Gauge is a measure of the diameter or cross-sectional area of the conductor (the thickness of the cable).

B

Bandwidth The difference between the highest and the lowest frequencies of a transmission channel (path for information transmission). Bandwidth identifies the amount of data that can be sent through a given channel, measured in Hertz (Hz or cycles per second). Higher bandwidth numbers mean higher data capacity.

BICSI (Building Industry Consulting Service International) BICSI is a non-profit industry association concerned with promoting correct methods for all aspects of the installation of communications wiring.

BNC A connector used to terminate coax cables. BNC stands for Bayonet-Neill-Concelman.

Broadband Sufficient bandwidth to carry multiple voice, video, or data channels simultaneously.

Bus A network topology in which nodes are connected to a single cable with terminations at each end.

C

Cable Assembly A fixed length of cable with connectors installed on both ends. Sometimes called a patch cord or patch cable.

Cable Bend Radius The amount of bend that can occur before a cable may sustain damage or increased attenuation.

Cat 5e A category of performance for inside wire and cable. Used in support of signaling rates of up to 100 MHz over distances of up to 100 meters. Calls for tighter twists, electrical balancing between pairs, and fewer cable anomalies than its predecessor, Cat 5. Cat 5e is intended to support 100BASE-T, ATM, and Gigabit Ethernet.

Cat 6 A category of performance for inside wire and cable; standard for UTP (Unshielded Twisted Pair) intended to support signaling rates up to 250 MHz. Applications include 100BASE-T, ATM, and Gigabit Ethernet.

Cat 6A Also called Augmented Cat 6 a category of performance for inside wire and cable. Used in support of signaling rates up to 500 MHz over distances of up to 100 meters supporting 10GBASE-T applications. Cat 6A cable will generally have tighter twists and varied pair twist rates when compared to Cat 6, these improvements allow Cat 6A rated cable to reject pair to pair and external interference. Connectors of this rating will employ design elements that further reject external noise, and limit pair to pair crosstalk.

CATV Community Antenna Television. A broadband system that transmits signals from a central antenna throughout a community via coax cable.

Coax Cable A cable composed of an insulated central conducting wire wrapped in another cylindrical conductor (the shield). Additional insulative and shield layers may be present. A coax cable has great capacity to carry vast quantities of information. It is typically used in high-speed data and CATV applications.

Compliance A wiring device that meets all characteristics of a standard is said to be in compliance with that standard.

Conductor Any substance, usually a wire or cable, that can carry an electrical current.

Connector A device that connects wires or fibers in cable to equipment or other wires or fibers. Wire and optical connectors most often join transmission media to equipment or cross connects. A connector at the end of a telephone cable or wire is used to join that cable to another cable with a mating connector or to some other telecommunications device.

Cross-connect Distribution system equipment used to terminate and administer communication circuits. In a wire cross-connect, jumper wires or patch cords are used to make circuit connections. In an optical cross-connect, fiber patch cords are used. The cross-connect is located in an equipment room, riser closet, or satellite closet.

Crosstalk See Near-End Crosstalk.

D

Daisy Chain In telecommunications, a wiring method where each telephone jack in a building is wired in series from the previous jack. Daisy chain is NOT the preferred wiring method, since a break in the wiring would disable all jacks "downstream" from the break. See also Home Run.

dB (Decibel) A dB is a unit of measure of signal strength, usually the relation between a transmitted signal and a standard signal source. Every three dB equals 50% of signal strength. Therefore, a six dB loss is a loss of 75% of reference signal strength.

E

Electromagnetic Interference (EMI) The interference in signal transmission or reception caused by the radiation of electrical and magnetic fields.

Ethernet A type of local area network used for connecting computers, printers, workstations, terminals, etc. within the same building. Ethernet is a physical link.

F

Fiber Optics High-bandwidth communication medium in which communication signals are transmitted in the form of light beams over glass optical fiber cables.

G

Gain The increase in signaling power that occurs as the signal is boosted by an electronic device. Measured in decibels (dB).

Gauge Refers to the diameter of wire. The higher the gauge number, the thinner the wire's diameter and the higher its resistance. See also AWG.

H

Hertz A unit of frequency equal to one cycle per second. Abbreviated as Hz.

Home Run Phone system wiring where the individual cables run from each phone directly back to the central switching equipment. Home Run cabling can be thought of as "star" cabling. Every cable radiates out from the central equipment. All PBXs and virtually all key systems work on Home Run cabling. Some local area networks work on Home Run wiring. See also Star Wiring, Daisy Chain.

Hybrid Connector A connector containing both optical fiber and electrical conductors.

I

Insulation Displacement Connection (IDC) A type of wire termination where wire is punched down into a metal holder, which cuts into the Insulation wire and makes contact with the conductor, causing the electrical connection to be made.

IEEE IEEE stands for the Institute of Electrical and Electronic Engineers, a publishing and standards-making body responsible for many standards used in LANs.

Impedance The total opposition (i.e. resistance and reactance) a circuit offers to the flow of alternating current. It is measured in Ohms, and the lower the ohmic value, the better the quality of the conductor.

Interconnect

1. A circuit administration point, other than a cross-connect or an information outlet, that provides capability for routing and rerouting circuits. It does not use patch cords or jumper wires, and typically is a jack-and-plug device used in smaller distribution arrangements, or that connects circuits in large cables to those in smaller cables.
2. An Interconnect Company is one which sells, installs, and maintains telephone systems for end users, typically businesses.

J

Jack A receptacle used in conjunction with a plug to make electrical contact between communication circuits. Jacks and their associated plugs are used in a variety for connecting hardware applications, including cross connects, interconnects, information outlets, and equipment connections. Jacks are used to connect cords or lines to telephone systems. A jack is the female component of a plug/jack connector system, and may be standard, modified, or keyed.

L

LAN (Local Area Network) A short distance network (typically within a building or campus) used to link together computers and peripheral devices (such as printers) under some form of standard control.

Link A transmission path between two points, not including terminal equipment, work area cables, and equipment cables.

Loopback A diagnostic test in which a transmitted signal is returned to the sending device after passing through a data communications link or network. This test allows the comparison of a returned signal with the transmitted signal.

M

Mbps (Megabits Per Second) One million bits per second. (Different from MBps, or a million bytes per second. Each byte is equal to 8 bits.)

MHz (Megahertz) A unit of frequency denoting one million Hertz (i.e., 1,000,000 cycles per second).

Modem A device that converts digital signals to analog signals for transmission over communication lines. Stands for Modulator-Demodulator.

Mud Ring The recommended low-voltage mounting bracket.

Multimedia A combination of more than one type of media, such as audio, video, and text.

N

Near-End Crosstalk (NEXT) Electrical noise coupled from one pair of wires to another within a multi-pair cable.

Network A network ties things together. Computer networks connect all types of computers and computer-related things— terminals, printers, modems, door-entry sensors, temperature monitors, etc. The networks we're most familiar with are long distance ones, like phones and trains. Local Area Networks (LANs) connect computer equipment within a building or campus.

O

Open (Fault) Means that the circuit is not complete, or the cable/fiber is broken.

Ohm A unit of electrical resistance. The higher the value, the greater the resistance.

Outlet A telecommunications outlet is a single-piece cable termination assembly (typically on the floor or in the wall), containing one or more modular telecom jacks. Such jacks might be Category Rated RJs (Registered Jacks), coax terminators, fiber-optic couplers, etc.

P

Patching A means of connecting circuits via cords and connectors that can be easily disconnected and reconnected at another point. May be accomplished by using modular cords connected between jack fields or by patch cord assemblies that plug onto connecting blocks.

PBX Private Branch Exchange. A small, privately-owned version of the phone company's larger telephone central switching office.

Performance Compare with compliance. A device can exhibit performance characteristics without being compliant to an industry standard.

Plug A male component of a plug/jack connector system. In premises wiring, a plug provides the means for a user to connect communications equipment to the communications outlet.

Polarity Polarity is the term describing which side of an electrical circuit is the positive and which side is

the negative. In multi-conductor or fiber communications cables polarity refers to the practice of identifying conductors by their color and selecting an applicable connection or termination scheme which assigns each conductor to a specific terminal, IDC, or in the case of fiber connector position to ensure device communication is achieved.

POTS (Plain Old Telephone Service) The basic service supplying standard, single-line telephones, telephone lines, and access to the public switched network. Each line of service is provided over a single twisted pair.

Pre-Configured Structured Cabling Panels Leviton hardware that combines various distribution modules onto single installation panels.

Punch Tool A spring-loaded tool for cutting and connecting wire in a jack or module.

R

RCDD The RCDD (Registered Communications Distribution Designer) title is a professional rating granted by BICSI (the Building Industry Consulting Service International). RCDDs have demonstrated a superior level of knowledge of the telecommunications wiring industry and associated disciplines.

Return Loss A measure of the similarity of the impedance of a transmission line and the impedance at its terminations. It is a ratio, expressed in decibels, of the power of the outgoing signal to the power of the signal reflected back.

Ring As in Tip and Ring. One of the two wires needed to set up a telephone connection. See Tip.

RJ Registered Jack. RJs are telephone and data jacks/applications registered with the FCC. Numbers, like RJ-11, RJ-45, etc. are widely misused in the telecommunications industry. A much more precise way to identify a jack is to specify the number of positions (width of opening) and number of conductors. Example: 8-position, 8-conductor jack or 6-position, 4-conductor jack.

S

Series Wiring See Daisy Chain.

Standards Agreed principles of protocol. Standards are set by committees working under various trade and international organizations.

Star Wiring/Star Topology See Home Run.

STRUCTURED MEDIA™ Center Leviton's central distribution center for structured cabling. Also known as an SMC.

Switch The point on a network where circuits are connected. Also, a switching node. In Local Area Networks, a switch is the core of a star as on ARCNET, StarLAN, Ethernet, and Token Ring. Switch hardware can be either active or passive. In home and small office networks switches are typically passive devices that augment the user's routing equipment. In more advanced networks managed switches provide additional features to improve quality of service, connect network segments, support virtual networks, etc.

Surge Suppression The prevention of voltage surges from reaching and damaging electronic equipment.

T

T1 A standard for digital transmission in North America. A digital transmission link with a capacity of 1.544 Mbps (1,544,000 bits per second). T1 lines are used for connecting networks across remote distances. Bridges and routers are used to connect LANs over T1 networks.

Telco An Americanism for Telephone Company.

Terminate To connect a wire conductor to something, typically a piece of equipment.

TIA (Telecommunications Industry Association) A trade organization of manufacturers which sets standards for use of its member companies. Formerly fell under the umbrella of EIA (Electronic Industries Alliance). See www.tiaonline.org.

Tip

- The first wire in a pair of wires. (The second wire is called the “ring” wire.)
- A conductor in a telephone cable pair which is usually connected the positive side of a battery at the telco. It is the phone industry’s equivalent of "ground" in a normal electrical circuit. See Ring.

Topology As in network topology. The geometric physical, optical, or electrical configuration describing a local communication network; the shape or arrangement of a system. The most common topologies are the bus, ring, and star.

Twisted Pair Two insulated copper wires twisted around each other to reduce induction (thus interference) from one wire to the other. The twists, or lays, are varied in length to reduce the potential for signal interference between pairs. Several sets of twisted pair wires may be enclosed in a single cable. In cables greater than 25 pairs, the twisted pairs are grouped and bound together.

U

UL (Underwriters Laboratories) A privately owned company that tests to make sure products meet safety standards. UL also administers a program for the certification of category-rated cable.

UTP Unshielded Twisted Pair. See Twisted Pair.

W

Wi-Fi® Any wireless local area network (WLAN) allowing computers, smartphones, or other devices to connect to the Internet or communicate with one another wirelessly within a particular area.

Workstation The working area in a building required by one telecommunications user. Industry standards call for one voice drop and one data drop for each workstation. The voice drop is one 4-pair unshielded twisted pair (UTP). The data drop may be 4-pair UTP, 2-pair shielded twisted pair (STP), or optical fiber.

WSMC The WSMC creates a central distribution point to manage both wireless and wired residential networks. The plastic construction supports the full reach of wireless signals, while providing easy installation, more capacity, and better thermal management.

# #

10BASE-T This is the IEEE standard that defines the requirement for sending information at 10 Mbps on unshielded twisted-pair cabling, and defines various aspects of running Ethernet on this cabling.

100BASE-T This is the IEEE standard that defines the requirement for sending information at 100 Mbps on unshielded twisted-pair cabling, and defines various aspects of running baseband Ethernet on this cabling.

1000BASE-T or 1GBASE-T This is the IEEE standard that defines the requirement for sending information at 1000 Mbps on unshielded twisted-pair cabling, and defines various aspects of running baseband Ethernet on this cabling.

10GBASE-T This is the IEEE standard that defines the requirements for sending information at 10 Gbps (Gigabits per second) on twisted-pair cabling, and defines various requirements for running baseband Ethernet on this cabling.

Appendix

Frequently Asked Questions

Why should I install Leviton's Connected Home system rather than assembling my own from off-the-shelf components?

Leviton offers a single, convenient package of tested materials that meet commercial-grade requirements. They are designed to work together without conflicts. They are also, in part, simple plug-and-play components that make the installer's job easier. The most popular structured cable functions are brought together in our Pre-Configured Structured Cabling Panels that conveniently meet most system requirements. Panels and components can easily be combined to build even larger systems.

I've always used electrical boxes. Why do you recommend mud rings for cable termination and device installation?

A mud ring gives the installer easy and ready access to the stud cavity and allows for a long service loop to be left in the wall without damaging the cable. Remember, low-voltage cable has to be handled more carefully than AC cable. Stuffing the cable in a box is not recommended since cable kinks and pinching can occur, which impacts cable performance.

Why can't I push my Category cable into a connector or distribution module with my screwdriver and clip the ends off with a wire cutter?

Category rated twisted pairs are made from a small-gauge wire (22 to 24 AWG). These conductors can easily be damaged with the wrong tools, and the system that depends on the cabling might not operate properly. Screwdrivers may also damage the IDC blades causing them to open and necessitating replacement. The proper tool to use is a punchdown/termination tool.

Why not use Cat 3 cable when it will satisfy the job requirements?

Leviton recommends Category 6 (a minimum of Cat 5e) for all residential low-voltage installations because of its greater carrying capacity that is more suited to current and future high-speed data applications. You're always better off installing a higher grade, structured cabling system, as it is far more adaptable to system changes and additions.

I understand that I can use Category cable instead of coax for video applications. Is this true?

You can use Category Rated UTP for video distribution with suitable adaptive devices. You might need coax-to-UTP converters at both ends of the cable run. However, it is far simpler from an installer and troubleshooting standpoint to, for each system, employ its respective cabling.

Should I be installing optical fiber cable instead of Category Cable? It seems that this is the direction future installations are headed.

Today typical residential fiber optic applications are limited to connection from the service provider equipment to the NID or in some cases to an outlet within the homeowner or tenant space which may be located within a STRUCTURED MEDIA™ Center. Installing fiber to each wallplate location should be considered in consultation with the homeowner or project consultant.

Installer Tips - Quick Reference

STRUCTURED MEDIA™ System

- The future will be filled with more low-voltage appliances and devices, not fewer. Keep expansion in mind when you and your customer discuss the system installation
- For both basic and residential, Leviton recommends a minimum of Cat 6 twisted-pair cable for telephone and data; RG-6 quad-shield coax cable for video cable, CATV, TV, DSS, and monitoring; and 16/2 or better class III stranded copper for speakers
- Leviton Pre-Configured Structured Cabling Panels combine the most popular distribution modules into single units that will suit the needs of many of your customers. These panels can always be replaced or supplemented with individual modules should your needs change in the future

Accessories

- Leviton recommends that you leave a 36-inch service loop for fiber optic cable and a 24-inch service loop for all other cable. This gives you plenty of spare cable to correct wiring errors and for future expansion should the end device need changing
- Be sure not to bend cable during the installation process. The integrity of the cable is important for maintaining optimal levels of performance
- Category rated cable requires precise termination. Removing too much insulation can adversely affect the efficiency of the cable. Tools manufactured specifically for trimming low-voltage cable will work more precisely than knives or diagonal cutters
- Cable should be tested regularly during installation so any problems can be repaired early in the job

System Design

- Your Leviton Technical Support representative can always assist you with any planning and installation challenges that occur outside of the scope of this manual. Call the Leviton Technical Support line at (800) 824-3005
- You can use a standard electrical box if you do not have a mud ring. However, be sure to remove the back section from the electrical box first. This will allow you to leave a service loop in the wall while providing a mounting surface for your device and cover plate
- Just as the NEC® prohibits the installation of AC electrical outlets above most baseboard heaters (Section 110-3[b]) because of the potential damage to any electrical cord plugged into that outlet, you will want to avoid installing a low-voltage device above these heaters for the same reason
- As you'll see in Section 8, be sure to run your low-voltage wiring in a separate stud space from the AC cable. Be sure your mud ring locations keep this rule in mind
- Leviton strongly suggests that you use nothing less than Grade 2 infrastructure
- Make sure all wire and cables meet all local safety and fire codes, and make sure that they are rated for in-wall use. Approved wire and cabling will feature a classification (such as CL-3, or Class 3) to indicate suitability for installation. Failure to follow this procedure could result in exposure to insurance and even legal problems
- Be sure to follow the speaker manufacturer's guidelines for wire gauge, and the amplifier manufacturer's recommendations for acceptable impedance loads
- Plan to install additional SMCs for audio/video distribution should your needs exceed the capacity of a single unit
- You want to keep electromagnetic interference (EMI) to a minimum (a five-foot separation between the SMC and large EMI producers such as AC panels and appliances is considered minimum). Mount the SMC in an accessible, centrally located, interior wall that does not require a two-hour fire rating

Pre-Wire

- No job will go flawlessly, but good communication skills coupled with your own vigilance will keep problems to a minimum
- Using two-way communication devices will easily allow the installers to talk with each other during testing
- Even the best technical installation can be marred by sloppy trim work. A crooked mud ring will yield a crooked wallplate. Take your time and mount the mud rings carefully
- An open, clear space in a closet makes a fine location for the SMC. For maximum flexibility, install a removable wood panel above and below the SMC, thus providing access to the wall cavity. This makes future cable installations considerably easier
- Use the cardboard mud guard to cover and protect the interior of the box and unterminated cables during drywall finishing. The mud guard will defray damage from other contractors and workers on the job. Store the SMC metal cover, in its original plastic protective covering, in a safe place until ready for trim out

- Quad wire is not an appropriate conductor for modern multi-line installations, and will result in poorly performing telephone/modem/fax services, as it will not allow high-speed data network communications. If you run across it during remodel work, replace it with Category 5e, 6 or 6A structured cabling. Any quad wire in a Category rated installation makes the entire wiring system susceptible to noise. FCC guidance outlaws the use of quad wire in applications connecting to the public telephone network (47 CFR Part 68 section 213).
- While many requirements for AC cable can apply in low-voltage cable installation, others do not. The FCC calls for the distance between an electrical box and the first strap or staple securing AC cable to not exceed 12 inches. This rule does not apply to low voltage wiring and would prevent you from leaving a service loop securely tucked inside of a wall
- An insulated staple is an ideal fastener for low-voltage wiring. The insulation acts as a built-in stop that prevents the staple from crushing or stressing the cables. Be sure the cable diameter does not exceed the staple's capacity
- To ensure optimal performance, keep cables six inches from all speaker and electrical wiring
- You can always install a second label some distance out from the termination point, say six inches, as a backup. This is especially useful during rough-in work where cable ends might get damaged. Also, you may want to trim the cable during termination
- One method for cutting down the confusion of multiple Category rated cables is to use one color of sheathing for your phone system and a second color for data and networking. The cable is all the same, but two different colors (say, blue and gray) make it easier to keep track
- For an even more foolproof identification, duplicate labels can be placed on the inside of the wallplate
- Common applications use speaker wire or twisted pair. Running both during installation will allow for easy upgrades or changes in the future

Trim Out

- The Leviton palm termination tool for holding jacks during punchdown provides a flat, level surface for punching down cable and cutting off the ends on the jacks. The tool fits in your pocket and is readily available when you don't have a convenient work surface
- It's worth repeating — to avoid removing too much of the jacket from the first (blue) or last (brown) wires, install either the orange (#2) or green (#3) wire first at the punchdown block. This helps to center the cable. Otherwise, if the blue pair is installed first and terminated close to the cable, the brown pair will extend further than one-half inch from the jacket, and therefore be more exposed than the standard calls for. Remember, the more exposure, the greater the chance for a substandard installation
- If you have run extra RG-6 cable through the home, it is a good idea to spec in enough splitter capacity and coax to handle an additional two television locations, more than the actual number of terminations required. This will allow for future expansion. If doing so, follow the same rule on any video splitter and cap all unused F-connectors with Leviton 75-ohm terminators
- Check with your CATV provider to determine the signal level at the house demarcation point. The input signal level from the CATV provider or local antenna will be between 0 dBmv and 15 dBmv. The lower end of that range will require a video amplifier. At the high end of the range, you might have sufficient signal to make a video amplifier unnecessary for up to eight video terminations. Beyond eight video terminations, you will probably need a video amplifier
- Reversing polarity, or connecting a "+" on the amplifier to a "-"on the speaker, will not cause any damage. It will result in a weak or thin bass sound and somewhat echoey or vague vocals. If you hear substandard sound from any installed speaker pair, shut the system off and simply reverse the connections to the back of one speaker only in that room. If the problem goes away, you have reversed polarity somewhere in the wiring. Make sure you check the connections right back to the amplifier because the other speaker pairs in the system may still be incorrect

Documentation, Testing, and Troubleshooting

- During rough-in, continually do visual inspections for damaged cables. Look for the most obvious problems before spending too much time doing instrument testing

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