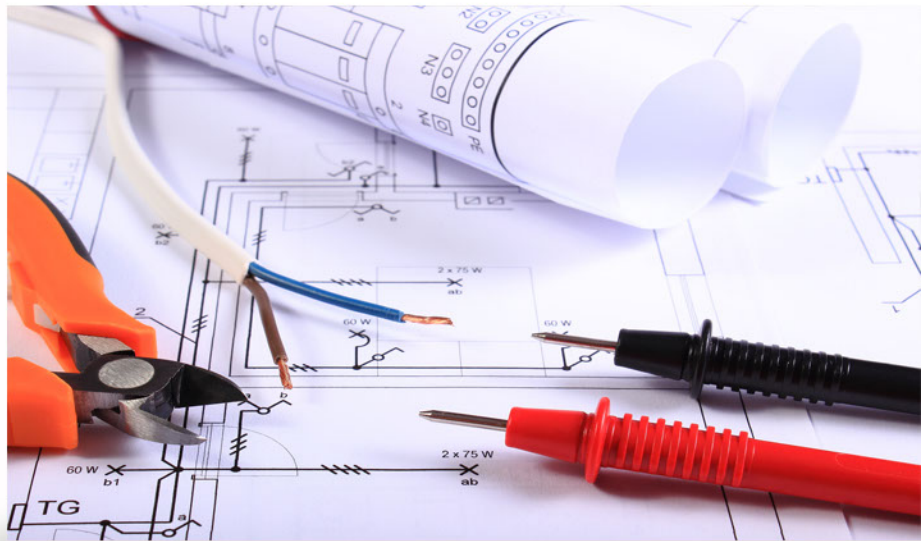
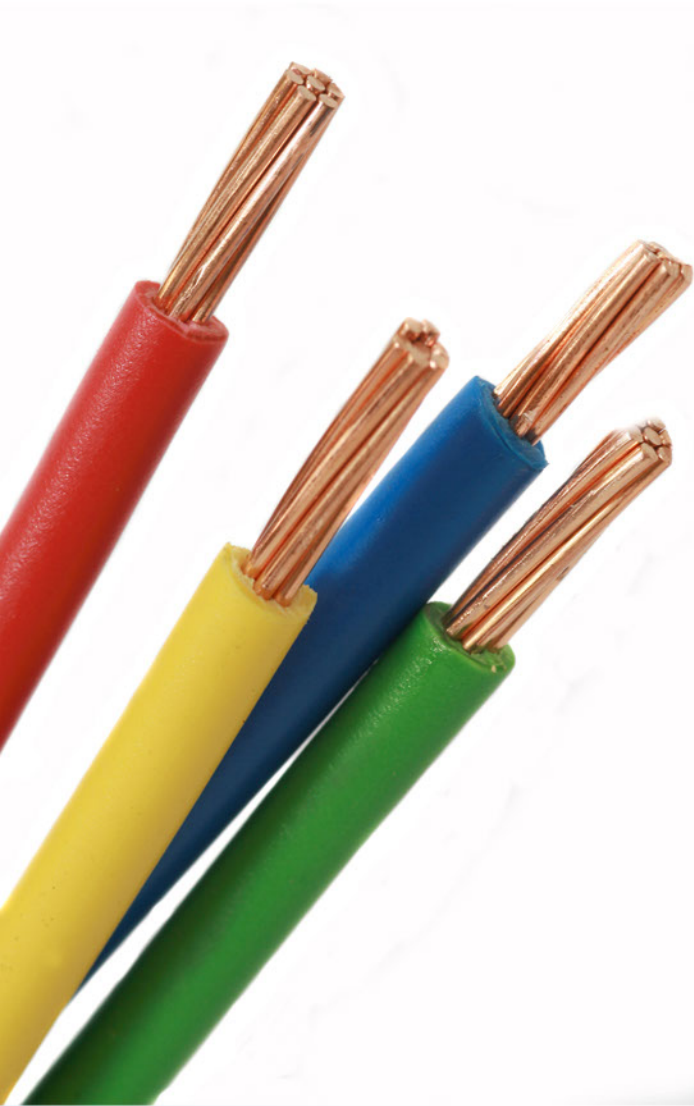


Wiring Guide For The Smart Home



Wiring the Smart Home

Today's home is more connected than ever with the lines between network, video and audio blurring. Where builders used to simply daisy chain some telephone cable from room to room, today and for the future, a structured plan is needed to take in to account the need for telephone, television, music, security and data. Structured wiring is incredibly important as it gives the home its central nervous system with which to communicate.

The heart of a structured wiring installation is typically one or more structured wiring enclosure(s) that will house distribution devices and wire termination points. All of the home's low voltage wiring will connect here. In larger installations, this may also take the form of a rack that houses network and cable termination, patch panels for networking, network modems, switches, routers and audio/video equipment. Typical locations for this main distribution point could be an electrical room or wiring closet.

When it comes to network and data, while WIFI does a nice job, it's truly not a replacement for wired Ethernet cable. Wired Ethernet can support Gigabit or higher speeds without interference and with better reliability. WIFI is a perfect addition to a wired network but when designing a new home it should not be the sole provider of network communication. Consider a typical family streaming 1080p or 4K video to each TV, listening to music, file sharing, playing online multiplayer games, downloading and the need for central network storage and it becomes apparent that wired Ethernet is easily the best choice over WIFI.

In the grand scheme of things, with the cost of construction and building materials, a good structured wiring system is inexpensive and can be key to the enjoyment of today's smart home. Being irritated by buffering video and broken audio will quickly reduce the enjoyment of the home.

The best time to run wires would be during construction or renovation, when studs are in place but walls are still open before drywall has been put up, and ideally after the plumber and electrician is finished. Otherwise the electrician may find it convenient to use some low voltage runs for high voltage electrical which can cause interference and poor performance for the low voltage system.

Network CAT5E and CAT6 Wiring

At least 2 x CAT6 wires should be run to each TV and audio location in the home. For media rooms or master bedrooms, 4-6 CAT6 wires should be run to support Smart TVs, gaming platforms, Blu-ray players, TV boxes, audio receivers, IR blaster systems as well as HDMI or HDBaseT video distribution. CAT6 is preferable here because not only is it capable of higher network speeds, but it also can be used for video distribution. Network wiring serves multiple purposes so there is some overlap when considering applications for data, video and audio. CAT5e or CAT6 may also be used for telephone wiring for those using analog phones as well as for VOIP or SIP handsets for more modern systems.

When in doubt, run a few extra wires for future expansion, particularly to main rooms like master bedroom, family/living rooms and media rooms.



Wiring the Smart Home

TV Wiring

RG6 or RG6 quad shield is your friend here. Run two RG6 cables from a central location to each planned TV location to support cable or satellite services. When planning the central location it should be near the cable and telephone demarcation point, which is where they enter and terminate inside the home or plan to run additional wires to this location.

In many cases it's desirable to hide the cable box, players and other equipment in a cabinet or nearby closet, or in the main structured wiring location. In the case of a nearby location, in wall rated HDMI cable will run from the TV to the source player.

When the source AV equipment is hidden, accommodation for IR control must be taken in to account since IR remote controls require line of sight to the equipment being controlled. In this case an IR distribution extender may be used and this could require a CAT5e/CAT6 run from the TV to the equipment area.

If you plan to automate TV's and audio video equipment consider wiring for control devices like Global Cache itach which use a network connection and can control devices by serial or IR blasters.



Distributed Video

Long HDMI cables become problematic and component video is rarely used. Instead CAT6 should be run from a 'head end' where video sources may be located to each TV display. HDMI over network cable or even HDBaseT can be used to distribute video using HDMI baluns. TV locations will also have a network connection that can be used to stream local video.

Audio Systems

We all love music, and yes there are many WIFI or wireless audio systems available, but there is much to be said for having the wires in place to support in-wall speakers and controls.

Speaker wire (16Guage or better, 4 conductor or 2 sets of 2 conductor) should be run from a central wiring location to a keypad or volume control location in each room. If using two conductor wire, loop it at the keypad/volume control location and continue on to each speaker location. If using 4 conductor wire to the keypad, terminate it here and run 2 conductor wire to each speaker location.



CAT5E or CAT6 wire should also be run from the central wiring closet or head end, to each keypad or volume control location.

This wiring plan, allows for both audio over CAT5/6 type systems where the amplifier is located in the keypad, as well as systems using a central amplifier.



Wiring the Smart Home

Security System Wiring

Security and alarm systems use wiring for power, keypads, wired sensors and communications. Wires should be run from central location where the alarm panel (brains) will be installed. This is often the electrical room or a wiring closet.

Alarm wire also known as zwire, station wire or 22-4 (22 gauge, 4 conductors) should be run to any planned sensor position including doors, windows, motion, glass break, smoke and CO detectors. Consider that every window and door on the main floor and in the basement should have a magnetic sensor. On the second floor, any windows with easy access, especially in the master bedroom, and any doors leading to a second storey entrance should also have sensors. Motion sensors are typically installed at the front and rear entrance areas on the main floor and should also be considered in the master bedroom and upstairs hallway. Glass break detectors are optional but can be used to protect against entry by breaking glass rather than opening a window and before motion is sensed. Glass break detectors can often protect more than one window. Smoke detectors are typically installed on the ceiling on each level and near sleeping areas. Check local bylaws and a security expert for locations. Carbon monoxide detectors should be installed on each level taking in to account furnace and combustion sources, living and sleeping areas. Carbon monoxide is odourless and deadly. Again check local building codes.



With alarm wire, two conductors are used for the sensor status, and in the case of powered detectors, the other two wires are for power.

This same alarm wire may be used for keypad locations although CAT5E or CAT6 is better as it can support a wider range of keypads including touch screens and allows for future growth. Typical keypad locations are at the front door or mud room door, patio door and master bedroom. Normally at least one keypad is necessary for arming, disarming and status. For power, 18 gauge 2 conductor wire is typically used from the power supply to the alarm system main panel. In a pinch, alarm wire can be used here by pairing conductors but this is not ideal.



Wiring the Smart Home

Heating and Cooling (HVAC) Systems

Check both the thermostat and furnace/AC manufacturer's recommendations but generally speaking you'll want to run thermostat wire to one or more thermostat locations and make sure to run cable with an extra connector for 'Common' which is a connection needed to power most automated thermostats. You may also consider running a wire(s) for outside temperature sensors.

With some automation systems and for a clean look it may be possible to install ONLY a small temperature sensor in a key room(s) and mount the thermostat where it won't be seen to have less clutter on the wall.



Security Cameras

Today's cameras are network based and so a single CAT5E or CAT6 cable should be run from a central location to each camera location. At the central location an NVR or network video recorder will generally be used to record and provide remote viewing and Internet access. If the NVR does not have built in ports for all cameras, a PoE (power over Ethernet) enabled switch will be used as the junction and power point, so this means you should also consider where your network junction or structured wiring panel will be located. The NVR will also need a network connection. You may also wish to run an extra CAT6 cable from the NVR location to planned TV locations in the home as this could be a means of watching cameras on your TVs by using HDMI over CAT6 extenders.



Lighting Systems

One of the most common home automation features is automated lights and scene lighting. Automated lights can automatically turn on when needed for convenience, safety and security, and automatically turn off to save energy. With scene lighting it's possible to use a single key on a keypad to command a group of lights to go to pre-set light levels perfect for reading, watching TV, entertaining or cooking. The effect can be stunning and the convenience is undeniable.

Most lighting controls are retrofit friendly so they can work with typical electrical wiring. However almost all automated light switches, keypads and dimmers will require both a hot and neutral wire connection at the switch and we highly recommend using nice deep electrical junction boxes for light switch locations as automated switches are much deeper than a regular toggle or paddle switch.

In some cases where rooms have 4, 5, 6 or more light switches in a single location, the designer may choose to put a single keypad on the wall and hide the switches and dimmers in a location out of the way such as a closet in order to keep wall clutter to a minimum.



While small to large homes can typically be automated using technologies such as Zwave, Insteon, UPB, Zigbee or other similar systems, with a very large home it may be preferable to use wired lighting controls rather than powerline or RF controlled lighting systems. In this case the electrical wiring requirements will change drastically with low voltage wire running from light switches to centralized relay and dimmer panels. Please consult with a professional for this sort of wiring plan.

Wiring the Smart Home

Planning, Documentation and Identification

When planning your structured wiring system it's vitally important to document your plans, wire runs and termination points. Using a floorplan of the home, mark your wire runs and connection points for each room.

As you pull wires, be sure to label both ends of each wire so you can easily identify them later, particularly at the central wiring location as you will have numerous cables. Use a system that makes sense to you and that can be easily documented.

Be careful as wires are delicate. Do not pull hard, force or bend wiring sharply. It's best to use very gradual bends as wires that kink will not perform well or at all. Make sure wires are protected from drywall screws and other construction dangers. Where wires are hung along ceilings make sure they are properly supported. Low voltage wires should be kept away from high voltage wiring. Low voltage wires should cross high voltage wires 90 degrees from each other.

It's also a good idea to take lots of pictures of the wire runs and termination points before drywall goes up in case you have trouble locating wire runs later.



Summary and Future Proofing

Careful planning can go a long way to ensuring the family's needs are accommodated now and in the future. If you're embarking on a do-it-yourself project, spend as much time as possible researching the types of lighting, automaton, audio and video systems you'd like to use and plan for future needs by running extra wires now. Wire is cheap and it's easy when the walls are open.

Another future proofing method is to run conduit from the basement and wiring closet to each floor and the attic, adding pull wires in each conduit. This makes it much easier to run wire later when the walls are finished.

If you have questions, give us a call at **416-800-0710** or **1-877-760-3105** toll free or contact us via www.aartech.ca or www.aartechpro.ca and we'll be glad to assist. We also love linking homeowners with installers who work with us as this becomes win-win for everyone involved.



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