Scaling Control4 Solutions to Fit Almost any Size Project
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Scaling Control4 Solutions to Fit Almost any Size Project

Although Control4® smart home technology has been designed for broad market adoption, many Control4 Dealers sell to the higher-end market as these higher-end homes are more accustomed to the features that make this technology attractive.

Additionally, many Control4 Dealers currently sell (or have sold) other home-automation systems when selling to larger homes. These dealers have reserved Control4 for smaller installations, believing Control4 to be less customizable and more limited than competing technologies traditionally popular in larger houses. These beliefs stem from Control4’s broad market positioning—beyond Control4 white papers—imposing many limitations and early adoption issues during Control4’s initial market entry.

This white paper documents **NEW benchmarks and limitations** by providing information that supports larger installations. Control4 Dealers are becoming more confident when selling Control4 products to homeowners with larger (17K to 24K sq. ft.) homes, and understanding that the information in this white paper will increase the Control4 Dealer’s ability to sell into larger installations.

Control4 is confident that by staying within the guidelines contained in this white paper, Control4 Dealers can continue to sell to not only the broad market adopters, but also to the larger (and very lucrative) traditional automation market.
Summary of Design Recommendations

<table>
<thead>
<tr>
<th>Primary Controller in a Version 1.6 Project (or later)</th>
<th>HC-200</th>
<th>HC-300</th>
<th>HC-500</th>
<th>HC-1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controllers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Primary Controllers</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>• Secondary Controllers</td>
<td>0</td>
<td>10</td>
<td>15</td>
<td>29+</td>
</tr>
<tr>
<td>• Total Controllers (Max)</td>
<td>1</td>
<td>11</td>
<td>16</td>
<td>30+</td>
</tr>
<tr>
<td>Digital Audio Streams</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Simultaneous Ethernet Streams</td>
<td>8</td>
<td>12</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>• Simultaneous WiFi Streams</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Audio Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Total Audio Zones</td>
<td>16</td>
<td>32</td>
<td>32</td>
<td>32+</td>
</tr>
</tbody>
</table>

These are guidelines that Control4 recommends and supports. This data assumes that your customer’s network is within our network guidelines and recommendations, is reliable, and is in good working condition.

If you move beyond these recommendations, we can still attempt to support you, but you will have to realize that you are above the recommended limits.

Also, keep in mind that certain factors, such as constant communication with third-party devices, like security panels or lighting systems, can impact performance as well. This may in turn cause the Navigator or ZigBee communications to slow down in systems where you do not have a Controller dedicated to only running Director/ZigBee (where Navigator is turned off).

<table>
<thead>
<tr>
<th>Primary Controller in a Version 1.6 Project (or later)</th>
<th>HC-200</th>
<th>HC-300</th>
<th>HC-500</th>
<th>HC-1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZigBee-Controlled Devices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Maximum # of ZigBee Devices</td>
<td>75</td>
<td>375</td>
<td>375</td>
<td>375*</td>
</tr>
<tr>
<td>• Running Zserver per Channel per Controller</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>N/A</td>
</tr>
<tr>
<td>• Zservers per Project</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>N/A</td>
</tr>
<tr>
<td>Graphical User Interfaces</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Maximum # of IP-based User Interfaces</td>
<td>10</td>
<td>20</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Digital Audio Library</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Number of Albums (10-12 Songs per Album)</td>
<td>2300</td>
<td>2300</td>
<td>2300</td>
<td>7200</td>
</tr>
</tbody>
</table>

*Requires an HC-200/HC-300 / HC-500 to run the ZigBee server.

We recommend up to 75 ZigBee devices per channel, and up to five (5) separate Zservers (set to different ZigBee channels – more information about changing channels is discussed later in this document).
## General Recommendations

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>• Hard-wire connection to Primary Controller</strong></td>
<td>A wired connection reduces the risk of being disconnected possibly due to interference problems with a WiFi connection. The Primary (Master) Controller should maintain a perpetual connection.</td>
</tr>
<tr>
<td><strong>• Primary Controllers set to static IP addresses</strong></td>
<td>(Not required) For easier management, we recommend that all devices be set to static IP, keeping a similar addressing scheme for all jobs.</td>
</tr>
<tr>
<td><strong>• Stable, robust network</strong></td>
<td>Any installation is only as good as the network it is running on.</td>
</tr>
<tr>
<td><strong>• One Controller per TV (HC-200)</strong></td>
<td>To avoid Controller conflicts resulting from multiple control screens accessing the same Controller, the best method is to run one Navigator per TV. The HC-200 makes this relatively easy.</td>
</tr>
<tr>
<td><strong>• Include an HC-1000</strong></td>
<td>Director runs much faster on this platform, so everything else also runs faster – <strong>REQUIRED</strong> for larger jobs.</td>
</tr>
<tr>
<td><strong>• Strong ZigBee mesh network</strong></td>
<td>ZigBee devices choose the best communication path to a Controller running the Zserver application. The Switches, Dimmers, outlets, and Keypads should be spread out to optimize this ZigBee communication.</td>
</tr>
<tr>
<td><strong>• Multiple Zservers</strong></td>
<td>Several Zservers reduce the load on one Zserver if more than 75 ZigBee devices are communicating in the project.</td>
</tr>
<tr>
<td><strong>• Always sell 4Sight</strong></td>
<td>In a large installation, 4Sight is a must to make support easier for you and to enhance the customer’s experience.</td>
</tr>
</tbody>
</table>

## Guidelines for Successful Installations

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>• Clear mutual understanding of project “completeness.” What is covered in the quote/scope of work? Change orders.</strong></td>
<td>You want to avoid getting stuck with a customer who believes every possible enhancement should be covered in the original bid. All of your sales margins can evaporate quickly unless your customers pay for enhancements, change orders, etc.</td>
</tr>
<tr>
<td><strong>• Set and agree upon realistic expectations for your customers.</strong></td>
<td>Know the time and effort required to implement each feature so you can scale your business more accurately.</td>
</tr>
<tr>
<td><strong>• Quote appropriately. Do not quote on perfect alignment of the stars.</strong></td>
<td>Things can go wrong, and you should pad the bid enough to compensate for potential loses in time and effort.</td>
</tr>
<tr>
<td><strong>• Have a third-party equipment integration plan.</strong></td>
<td>So you don’t run into known problems with different device types, drivers, etc.</td>
</tr>
<tr>
<td><strong>• Troubleshoot on friendly ground, not in the customer’s home.</strong></td>
<td>Bench test the gear and drivers in a friendly environment like your showroom or your home so you don’t have to bench test or troubleshoot as much at the installation site.</td>
</tr>
<tr>
<td><strong>• Be prepared. Use planning tools.</strong></td>
<td>Your customer will perceive you as being more professional as you incorporate these tools into your bid/sales process.</td>
</tr>
<tr>
<td><strong>• Understand your customer. What do they really want?</strong></td>
<td>Often, your understanding of what the customer wants and the customer’s idea of what the final deliverable looks like can be out of sync. Make sure you know exactly what they understand about a particular product or lifestyle benefit before attempting to offer something that missed their definition and expectations.</td>
</tr>
<tr>
<td><strong>• Develop a comprehensive, realistic plan and keep it up-to-date.</strong></td>
<td>Working from a plan helps keep your time and effort as efficient as possible.</td>
</tr>
</tbody>
</table>
Large Lighting Implementations

You can change ZigBee channels to improve performance in circumstances when you have more than 75 ZigBee devices, or when you would like to improve performance in situations where you have clusters of devices separated by distance. An example might be a main residence and separate garage or guest home where you would want to have multiple Zservers.

This concept can also depend on a home’s layout as well. Dealers have told us they may configure 40-50 devices per channel with local Zservers in particularly-large installations.

Prevent Problems When Changing Channels

All Control4 ZigBee devices are shipped on a default channel (14). There are a few things to be aware of if you start changing ZigBee channels in a project. Imagine what happens if you've changed the channel on the node being used to hop while keeping devices that are further away on their original channel. The further away the devices are, if they are still on their original channel, they can no longer use the devices they were hopping through, so they become “islanded.”

In other words, the device’s channels do not get changed with the other devices that have been providing a communication path. These devices can no longer hop through other devices to communicate with a Controller running Zserver.

To resolve this potential problem, set up or move a Controller into several different parts of the home so all devices in that area can receive the new channel assignment (as represented in the image below).

You move a Controller into a smaller cluster of devices or areas one at a time. Then you change all the devices in this particular area to the new channel at the same time so you are not segregating a device.
ZigBee Channel Changing Application

Instead of having to manually send a command to each device to change the device’s ZigBee channel, Control4 has developed a utility that provides an easier way to change the ZigBee channel on one or more ZigBee devices. This utility is available on the Control4 Dealer Forum and is called, “Changing the ZigBee Channel on Control4 Devices.” Instructions for using the utility are included with the program. You can search the Control4 Dealer Forum to download this utility.

IMPORTANT: Please read the instructions before using this program! Potential problems can exist from not reading the instructions before using it. For example, although status normally appears at the bottom of the application window, if it does not display properly, you risk closing the application before the devices actually switch channels. Maximize or stretch the utility so you can see the status/progress bar along the bottom of the program. Do these tasks before you start to change channels.

Also, please remember not to allocate channels by device type (i.e., don’t assign one (1) channel to all the six (6) Button Keypads, one (1) channel to all the Dimmers, one (1) channel to all the Switches, etc). Instead, **maintain a good ZigBee mesh network in the home**, and change the channels one (1) cluster of devices at a time.

(See Appendix for “Tips on Changing the ZigBee Channels” for relevant tip information.)

Augmenting the Mesh Network

Use additional Outlet Switches, Keypads, Switches, and Dimmers or consider other third-party products to augment and enhance the ZigBee mesh network in the home.

The products that **do not augment** the network include: Speaker Points, System Remote Control devices, Touch Screens, Controllers, Tstats, Contact/Relay extenders, Amplifiers, Matrix Switches, and Tuners.

The third-party products that are or can be battery powered are not hopping points, and do not enhance the mesh network. Contact the third-party manufacturers for specifics on how the product enhances the mesh.
Large Audio/Video Implementations

A Control4 system is optimized for use with a Control4 distributed audio solution. We do not recommend using non-Control4 audio products in a larger installation. For example, do not use the integrated tuner in a receiver for whole house audio; instead, use a Control4 Tuner.

Use an Amplifier instead of Speaker Points when possible (4-Zone Amplifier now available). If you are using 2 Amplifiers, use an Audio Matrix Switch to provide original sources to both amps simultaneously.

16 Analog Sources to 32 Zones

To efficiently handle 32 Zones of Audio, we recommend Y-splitting your sources or using a distribution Amplifier to split the sources between two (2) Matrix Switches, and then connecting the Matrix Switches to two (2) Amplifiers each (as shown in the figure below).

Note: Due to the “Dynamic Audio” capability of the Control4 system, we require that you do not split the analog audio outputs from a Controller (as noted in the figure above).

Also, the lines shown in the figure above would be more confusing if showing all connections from the Matrix (16 outputs) to the Amplifiers. The picture only shows three (3) lines to each Amplifier, but the example refers to all outputs connecting to the Amplifier.
More than 32 Zones of Audio

More than 32 Zones:
Split sources (use a distribution amplifier)
More Matrix Switches and more Amps
Split Analog Sources - Cable Box, Tuner, CD player, etc to multiple Matrix Switches
Digital Audio (Analog Outputs) from Controllers Can NOT be split.

You can scale this method further than 32 Zones using a distribution Amplifier instead of a Y-splitter (as shown in the figure above).

Also, with respect to Media Scenes, use Digital Audio programming to join rooms/sessions together instead of Media Scenes unless the Media Scene is for only one (1) room with four (4) or fewer pairs of speakers in it.

If using the Dock for iPod for video and audio, Y-split the audio between the TV or Receiver and a Controller audio input if you want the music to be available to Speaker Points or the whole house audio system. This will keep the audio accompanying a video in sync on the TV, as running analog audio through a Controller introduces a delay in the sound.
How to Configure When one Room has Multiple Speakers?

When setting up a Control4 distributed audio system in a room with multiple speakers, use the Matrix Switch as the Room Audio Endpoint & Volume Control. Do not lock the inputs on the Properties page of the Amplifier. Use the front panel of the Amplifier to assign outputs to inputs. In the example shown in the figure above, on the Amplifier to the left, outputs numbers 1-6 are assigned to input number 1 using the front panel interface on the Amplifier. This can also be done in the Programming tab in Composer.

We recommend using programming to schedule daily input/output assignments in case the Amplifier loses the front panel settings due to an update or unforeseen issue OR program it when audio is sensed on a certain input on the Amplifier to connect the other outputs to that input.

When using this option, the Matrix Switch handles volume, and the Amplifier inputs stay unlocked in the Properties page of the Amplifier. Additionally, the Amplifier volume levels should be fixed at (70-80%).
Here are examples of two (2) methods to assign the outputs shown in the figure above to input #1 on the Amplifier:

**Method #1:**

When audio is sensed on the Amplifier Input, assign outputs to that input.

**Method #2:**

Have a daily scheduled event that assigns the correct outputs to the same input.
What about Video Switching?

It is possible to distribute Navigator to multiple TVs, but there can also be conflicts if more than one person is using the Navigator UI coming from the same Controller. Control4 recommends 1 Controller per TV.

When you determine which Controller is sending its Navigator to which room, make sure you have the correct Controller designated as the “Onscreen Device” on the Room Connections page (as shown in the picture below).

If your sources are not coming from a Controller, or if you use an AV Switch that can separately matrix audio and video, then it is OK to use a combo Audio/Video Switch. Due to the “dynamic nature” of a Control4’s Controller audio outputs, we recommend separate Audio and Video Switches if sourcing from a Controller’s video and audio (as shown in the figure below).
When setting AV Switch connections in Composer, you can modify Navigator to view the correct sources. In Composer, use the Navigator tab from Room Properties in System Design to select which sources are available in each room (as shown in the figure below).

Also, be sure to verify the AV Switch connections in Composer (as show below).
Large Systems Networking Considerations

Recommended Networking Hardware

Control4 Dealer feedback indicates that using separate router and access points (non-combo devices) offer the best chance for problem-free Control4 networking environments.

Here are a few examples that have been used successfully:

<table>
<thead>
<tr>
<th>Device Type</th>
<th>Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated router</td>
<td>Linksys RV042</td>
</tr>
<tr>
<td>Access point</td>
<td>Pakedge (wap-w3)</td>
</tr>
<tr>
<td>Antenna</td>
<td>Luxul (Note: Please watch webex recording on Luxul)</td>
</tr>
</tbody>
</table>

If you need Multiple Access Points, consider assigning different SSIDs to each access point. Most wireless clients are set to be very "sticky" (as is the case with all the Control4 panels), therefore, they do not switch to another access point until they lose the signal from the one with which they originally were associated. This means they will stay connected with low throughput instead of switching to an access point that would provide higher throughput. The homeowner’s laptop or other non-C4 devices will typically not behave in this fashion, however. If you are not using Control4 WiFi devices, you can assign the same SSID to more than one access point.

**DO NOT USE** the Linksys WRT54G router (any flavor) or other inexpensive, entry level routers; they are not designed to handle automation systems.

Additional Recommended Routers/Access Points

**Note:** We update this list periodically, and it can be found on the Control4 Dealer Forum. Search for the thread called "Control4 Recommended Networking Hardware."

**Wifi Routers:**

<table>
<thead>
<tr>
<th>Router</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linksys WRVS4400n</td>
<td>With updated firmware to fix wireless DHCP issues – available on the Control4 Dealer Forum.</td>
</tr>
<tr>
<td>Linksys: RVS4000</td>
<td></td>
</tr>
<tr>
<td>Linksys: RVL200</td>
<td></td>
</tr>
<tr>
<td>Linksys: RV042</td>
<td></td>
</tr>
<tr>
<td>Apple: Airport Extreme</td>
<td></td>
</tr>
<tr>
<td>Netgear: WNDR3300</td>
<td>Recommended for 1 or 2 zone systems. WiFi doesn't work with b devices V1 MTS, V1 10.5's.</td>
</tr>
<tr>
<td>Netgear: WPN824 v2</td>
<td>Recommended for 1 or 2 zone systems.</td>
</tr>
</tbody>
</table>

**Access Points:**

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Com: 7760</td>
<td></td>
</tr>
<tr>
<td>Linksys: WAP4400N</td>
<td></td>
</tr>
<tr>
<td>Netgear: WPN802</td>
<td>Recommended for small systems.</td>
</tr>
<tr>
<td>Pakedge: WAP-W3</td>
<td></td>
</tr>
</tbody>
</table>

**Wi-Fi Antenna:**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luxul Pro-WAV</td>
<td>Flat Panel Range</td>
</tr>
</tbody>
</table>
Here is a short list of Control4 Dealer Recommended Networking Hardware

### Routers:
- Dlink EBR-2310
- Linksys RV042
- Linksys RV5400
- Linksys WRVS4400 (see note about updated firmware)
- Apple Airport Extreme

### Access Points:
- OnQ In-Ceiling IAPs (364887-01)
- Linksys WAP4400N
- Apple Airport Extreme
- Dlink DWL-3200AP
- Netgear WG102

### Switches:
- Netgear FS108NA & FS108PNA – 8 port & 8 port PoE
- Netgear FS116NA & FS116PNA – 16 port & 16 port w/8 port PoE
- Netgear JFS524NA – 24 port
- Linksys or Dell Business class (non-managed)

### Additional Dealer recommendations:
- Wire the Primary Controller to the main router.
- Do not use combo router/wireless access points.
- Wire all Control4 devices to the same Switch.
- Do not use managed Switches – setup of managed Switches can be difficult.
- Do not cascade Switches (one Switch connected to another to another, etc.).
- Stay away from Wireless N (turn off N and use mixed B&G).
- Use a pc class UPS device for the router and Controller (i.e., APC, CyberPower).
- Some Control4 Dealers are using CAT6 cabling and punch downs throughout, while others are using CAT5e. Both work; be sure to test all your wire runs no matter which standard you go with.
- Use static IP for all devices, and use the same addressing scheme for every project.
- Keep all devices on the same network.
- Subnet only if the customer experiences bandwidth issues.
- Typical networking issues.
- Avoid using the Linksys WRT54G.(Do not use an entry-level router for automation.)
- We recommend SOHO class networking gear.
- Do not allow for more than one (1) DHCP server on the same subnet.
- Do not use WiFi range extenders.
- Watch for incorrectly-entered SSID and WEP Key information into the Control4 WiFi products.
- Be careful when wiring and when terminating your wire runs.
- If using the customer’s networking equipment, do not assume it is set up correctly.

White paper for recommended networking hardware online – current as of March 09, 2009
Includes setup instructions for some of these hardware models.
Additional Reminders

Multiple HVAC Unit Reminders
- One (1) Thermostat per distribution panel (per Zone).
- Power Stealing is NOT recommended; instead use a common wire to each Thermostat.
- Wire the Control4 Thermostat exactly like the original thermostat.
- Test for control of HVAC system before adding the Thermostat to the Control4 project.
- For larger HVAC systems, consider using Aprilaire or Honeywell in multi-zone damper-control situations (we recommend that you consult with an HVAC pro).
- Do not wire external temp sensors or Thermostats with stranded wire.

Performance Optimization Reminders:
- Turn off Navigator on Controllers that do not output to a TV.
- Turn off Audio Clients on Touch Screens that are not transmitting audio.
- Try WinSCP to copy large volumes of media to the HC-500 or HC-1000 to save on transfer time. Visit: WinSCP.net.

Cool Things (Add-ons) that Can Help Maximize Your Profits
- Caller ID on Navigators with thirdparty box that interfaces with a Controller (www.callerid.com)
- Doorbell Kit with Announcement Agent
- Garage Door Kit
- IP Cameras
- Electronic Gate
- Tennis Court Lighting
- Security System Integration
- WeatherBug® Integration
- Pool Control
- Pool Lighting

Additional Information Resources
- Control4 Dealer Forum - forums.control4.com
- KnowledgeBase - https://support.control4.com
- Troubleshooting Guides – KnowledgeBase, Control4 Forum
- Dealer Website – www.control4.com/dealer
- Online Training Topics - control4.webex.com
- Training - Tech 1 Intro, Tech 2, Level 1 and Level 2 Sales
- Best Practices Documents – Dealer Website /Control4 Forum
- C4 Blog: http://control4blog.com/ 
- Show all programming and connections tool: http://control4blog.com/control4/apps/projectreports/
- Technical Support – 888-400-4072

Additional Networking Online Resources
- www.compnetworking.about.com/cs/wirelessproducts/a/howtobuildwlan.htm
- www.derose.net/steve/guides/wiring/ Great guide for additional “how to” information on building a home network!
- computer.howstuffworks.com/wireless-network.htm
- www.cnet.com (Choose Tips and Tricks, and then the Networking learning hub link)
- www.bedrocklearning.com Home Networking for Installers
- www.trainingdept.com Home Networking seminars
- www.moonblinkwifi.com/wifi_acronyms.cfm Common wireless acronyms
- www.smallnetbuilder.com/ & forums.smallnetbuilder.com/
## Appendix

### ZigBee Channel Changing Application Tips

- Change channels by floor/area.
- Keep in mind ZigBee hops through floors; so if possible, change the devices based on physical proximity to each other. The closest Zserver may be on another floor.
- Finish one floor/area first, and then move to another area.
- Do not set all Dimmers to one channel, all Keypads to another channel, etc.
- Go into Composer and rename the ZigBee devices in one area at a time by adding a “z” in front of the name (for easier sorting and troubleshooting later).
- For quick renaming: Use F2 – Home – z – Enter.
- To change the name back: F2 – Home – Delete – Enter.
- When the devices in one area are renamed, start the ZigBee application.
- Load your project.
- Sort by device name to group all the devices with z in their name together.
- Select the first of the z devices by clicking on its MAC address.
- Hold down the Shift key, and select the last z-named device by clicking its MAC address.
- When all z-named devices are highlighted, click in one of the checkboxes next to the highlighted device, and it will check all the highlighted devices.
- Follow the directions included with the application to disable Director. Connect to the Zserver, and then set the channel to tell the devices to go to.
- After devices in one (1) area are renamed.
- Pick channels at least 3-4 away from the default channel 14 (channel 11, channel 7, etc.).
- Watch the status of devices as they are sent channel change commands to make sure all devices complete the channel change command.
- After all devices and the new Zserver have switched to the new channel, launch Composer and turn off the Zserver that is still on the default channel.
- Select Tools/Network Status and sort by device name or status to make sure all of the changed devices are online. This may take a few minutes to register correctly in Composer while all of the devices come online with the new Zserver.
- Not Addressed or Offline status are red flags; the device may not have had its channel changed.
- Bring the default Zserver back online and rename devices to their original name by deleting the z, and then do this same set of steps for the next floor.