

CREE SMARTCAST® POE TECHNOLOGY

QUICK START DEPLOYMENT GUIDE

INTRODUCTION

SmartCast® PoE leverages Power over Ethernet technology in partnership with Cisco's Digital Ceiling initiative to provide intelligent lighting using a single Ethernet cable connection. The combined efforts of facility managers and IT are essential to the success of a PoE lighting network deployment. This guide provides a brief summary of recommendations and requirements necessary for a successful SmartCast PoE installation (including setup and commissioning). The intended audiences for this guide are IT and Facilities stakeholders and the guide is applicable for SmartCast PoE v1.2 and above.

The SmartCast PoE family of fixtures currently consists of the following products:

- The **CR Series architectural troffer** which contains the CR22™ and CR24™ CCT adjustable fixtures
- The **KR Series downlight** which contains the KR6™ fixed color fixture in 3500K and 4000K variants
- A **wall dimmer** with ON/OFF and Dimming functions

The SmartCast® PoE system does not currently offer an emergency backup fixture. An external AC-powered emergency backup solution must be specified to provide this capability.

The Cree SmartCast Manager™ Windows® application uses OneButton™ Setup to provide the commissioning of the SmartCast® PoE network. No control or data gathering is available until the endpoints have successfully completed the commissioning process. SmartCast Manager™ and the SmartCast® Configuration Tool together serve as editing tools for existing SmartCast® PoE networks.

REFERENCES

The following documents provide further details about the design, installation and operation of the SmartCast® PoE System:

- *Cisco Digital Ceiling Cree Design Guide*
- *Cisco Digital Ceiling Cree Implementation Guide*

SMARTCAST® PoE WORKFLOW

A successful SmartCast® PoE installation typically follows the workflow shown below. This guide provides details for each step of the workflow process.

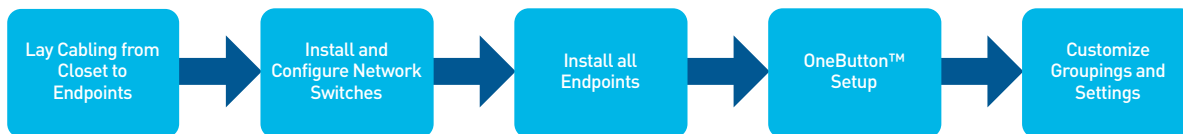


Figure 1. SmartCast® PoE Workflow

According to the *Cisco Digital Ceiling Cree Implementation Guide*, a SmartCast® PoE installation has the following network topology.

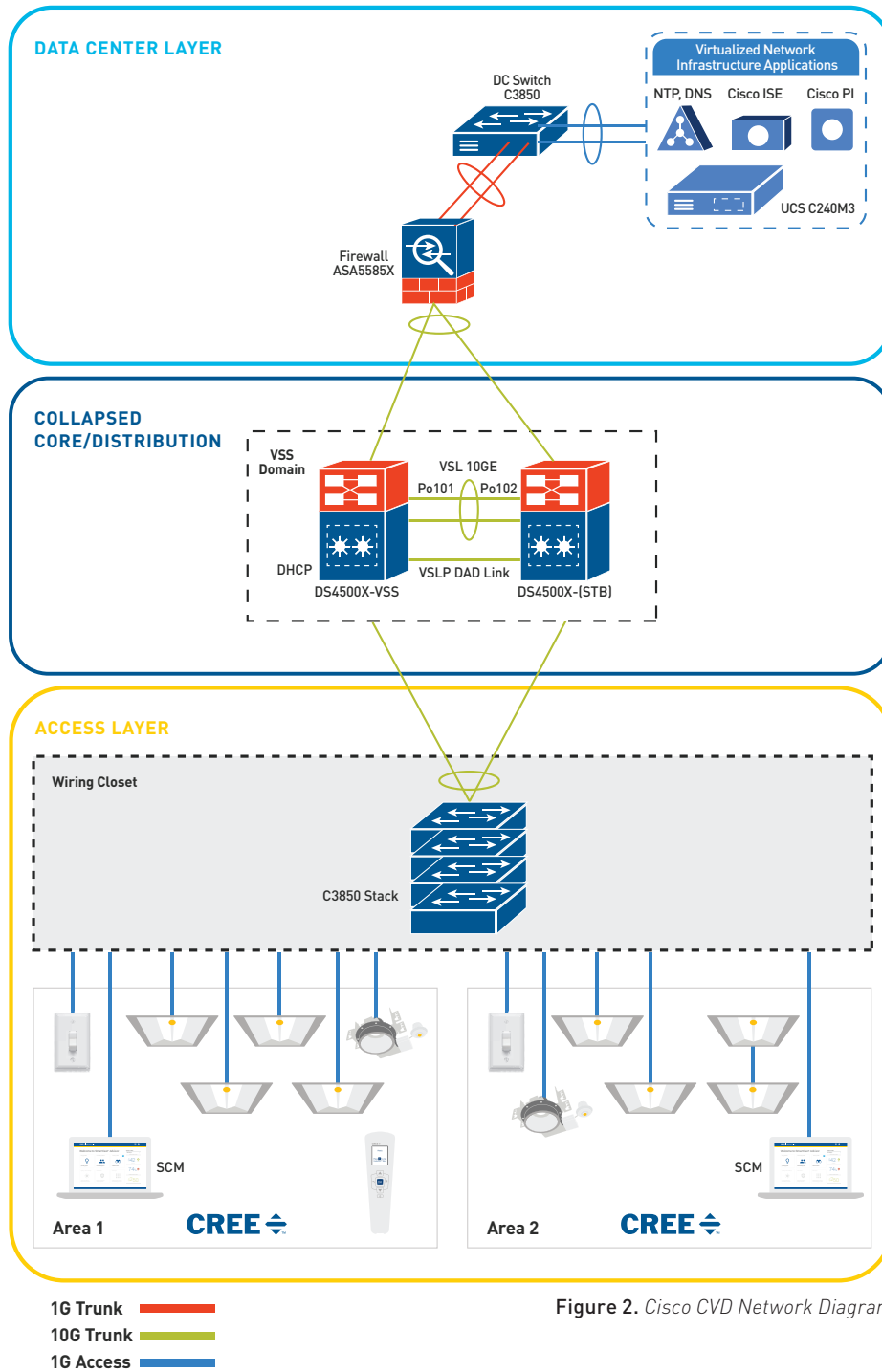


Figure 2. Cisco CVD Network Diagram

ETHERNET CABLING

Each SmartCast® PoE endpoint (aka light or dimmer) relies on its own independent Ethernet-compliant cable run to provide power and data flow. This cable run consists of:

- A patch cable between the network switch and the patch panel
- A bulk box run between the patch panel and a terminal box in the plenum at the distant end
- A patch cable between the terminal box and the endpoint

The cable runs must be plenum-grade CAT5e or CAT6a with a minimum cable gauge of 23 AWG. The maximum cable length for each run cannot exceed 100 meters. The bend radius of a CAT5e or CAT6a cable cannot be smaller than four times the cable diameter as shown in Figure 3 below.

CAT5e patch cables must be used to connect wall dimmers to the distant end terminal boxes. This provides the added cable flexibility required in order to address the space limitations within the junction boxes that house the wall dimmers.

All cable lines must be certified end to end for continuity and data prior to connecting to SmartCast endpoints.

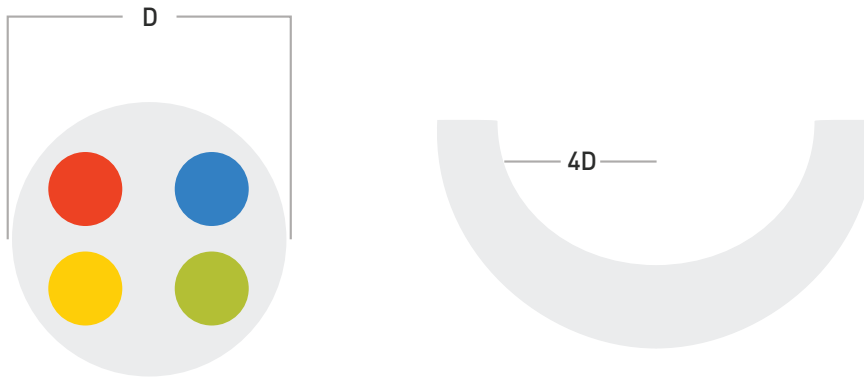


Figure 3. Cross section of CAT5e cable defining Bend Radius

CAT5e patch cables must be used to connect wall dimmers to the distant end terminal boxes. This provides the added cable flexibility required in order to address the space limitations within the junction boxes that house the wall dimmers.

All cable lines must be certified end to end for continuity and data prior to connecting to SmartCast[®] PoE endpoints.

ETHERNET SWITCH SETUP

SmartCast[®] PoE Technology utilizes the Cisco Catalyst[®] 3850 Series of UPOE switches. The WS-C3850-24U switch should have IOS version 3.7.0EX installed which supports PoE functions. This IOS code is an engineering version that may not support all of the necessary features for deployment in a production environment. Cisco is developing a General Availability release that contains the PoE-specific functions.

Two hardware installation solutions are supported for the Cisco[®] 3850 Series of switches: a centralized solution with the switches installed in a rack within a wiring closet and a distributed solution with the switches housed in wall-mounted racks or in plenum-rated ceiling racks collocated with the Cree[®] light fixtures they support.

In either case, a patch panel should be installed along with each switch to provide the most flexible cable routing options. Both solutions support Cisco StackWise[®] technology.

ATTENTION: The lighting network switches should be isolated from the enterprise production network either physically or through security measures in order to prevent unauthorized access to either network.

Redundancy of lighting is a critical safety feature of the SmartCast[®] PoE system. To prevent all lights in a space from shutting down in the event of a power loss or network service interruption, lights should be distributed across multiple switch stacks as shown in Figure 4 below. The power supplies of each switch should also be split between two independent AC circuits to allow for power redundancy.

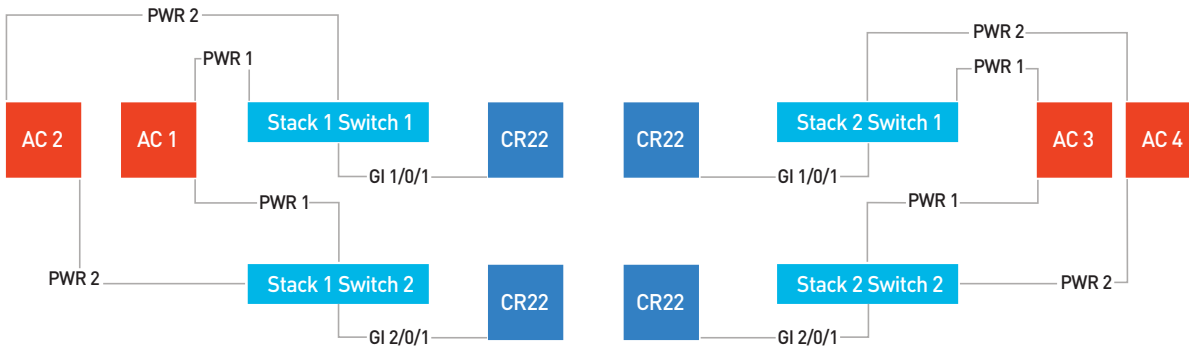


Figure 4. Establish lighting redundancy to prevent all fixtures losing power when a switch or AC feed goes down.

The switch configuration settings shown below are the recommended settings for optimal SmartCast® PoE operation. This configuration must be applied prior to connecting any SmartCast® lights or wall dimmers to the switches. Please refer to the *Cisco Digital Ceiling Cree Implementation Guide* for additional information prior to implementing the switch settings below.

SMARTCAST® PoE REQUIRED SWITCH SETTINGS

Create one or more dedicated VLANs for the SmartCast® PoE implementation. A single VLAN may support up to 1,000 lights or wall dimmers, but Cree recommends 500 devices per VLAN for a typical installation. Use the following commands to create the VLAN. The provided example will create VLAN 4 with an IP subnet of 192.168.4.0/24.

Create the VLAN:
interface vlan 4
 Assign a router IP address:
ip address 192.168.4.1 255.255.255.0
 Assign the switchports to the VLAN:
switchport access vlan 4

A DHCP server is required to provide IP addresses for the lighting network. If you do not have an existing DHCP server infrastructure, you may use the commands below to create a DHCP server on the switch.

Create the DHCP pool:
ip dhcp pool CREE
 Assign the DHCP pool a subnet:
network address 192.168.4.0 255.255.255.0
 Assign the default router for the DHCP pool:
default-router 192.168.4.1

Configure all PoE ports as Layer 2 access ports:

switchport mode access

Enable LLDP negotiation:

lldp run

Enable Perpetual PoE and Fast PoE on each switchport dedicated for lighting:

power inline port poe-ha

Enable spanning-tree features on each switchport dedicated for lighting:

spanning-tree portfast
spanning-tree bpduguard enable

Enable SNMP to take advantage of the SmartCast Manager™ selective commissioning feature:

snmp-server community public RW

ATTENTION: SNMP allows authorized users to operate the selective commissioning and port control features of SmartCast Manager™. This configuration setting should be applied in conjunction with other security measures to prevent unauthorized access to the lighting network.

The 3850 Series switches come in both 24-port and 48-port variants. Each switch can be outfitted with a maximum of two 1100-watt power supplies. The maximum power budget per switch is 1800 watts, regardless of the switch model in use. *(Please see the comments below for special considerations when using the 48-port switch.)* To maximize the power budget it is required that all switchports dedicated to lighting be configured for static inline power using the settings in Table 1 below.

PoE Device	Wattage** / Command to Configure Port
Cree PoE wall dimmer	15.4W / power inline static max 15400
Cree CR22™ architectural troffer	44.2W / power inline static max 44200
Cree CR24™ architectural troffer	53.0W / power inline static max 53000
Cree KR6™ downlight	38.0W / power inline static max 38000

Table 1. Static power values and commands

** The wattage values shown already account for maximum power and “longest cable” line losses.

ATTENTION: As mentioned above, the maximum power available to the switches is 1800W. This is a result of the 80% efficiency rating of the PSUs (1100W x 2 = 2200W x 80% = 1800W). Be advised that a 48-port switch cannot supply more than 37.5W per port (1800W / 48) if all ports are being used to power devices. Additionally, in an installation of CR24™ troffers, only 33 ports of the 48-port switch can be used (53W x 33 = 1749W). The remaining 15 ports can still be used for normal network traffic but they cannot be used to power devices. For these reasons, Cree recommends specifying the Catalyst® 3850-24, which can provide full power to all ports at all times.

SMARTCAST® PoE RECOMMENDED SWITCH SETTINGS

Cisco recommends the following security commands to protect the lighting network. These commands are not required for the operation of the lighting network.

Enable storm control to protect against broadcast traffic storms: **storm-control broadcast level 50.00**

Enable storm control to protect against multicast traffic storms: **storm-control multicast level 50.00**

Enable IP DHCP snooping globally on the switch: **ip dhcp snooping**

Enable IP source guard on each switchport dedicated for lighting: **ip verify source**

Enable ARP inspection for the VLAN:

On each switchport dedicated for lighting:
ip arp inspection trust

On each switchport dedicated for lighting:
ip arp inspection limit rate 100

Enable globally:
ip arp inspection vlan 4

Enable port security on switchports dedicated for lighting:

switchport port-security
switchport port-security violation restrict
switchport port-security mac-address sticky
switchport port-security aging type inactivity

ENDPOINT SETUP

SmartCast® PoE endpoints consist of two major device types: light fixtures and wall dimmers. All light fixtures have integrated occupancy and ambient light sensors. All dimmers have integrated ambient light sensors. All light fixtures and wall dimmers should be installed and powered prior to starting the SmartCast Manager™ application and performing the OneButton™ Setup procedure.

Wall dimmers contain ambient light sensors that are used during the OneButton™ Setup to associate with the light fixtures that they are expected to control. The wall dimmer must be installed in a location that allows its sensor to detect light from the fixtures to facilitate commissioning. In other words, the dimmers should face the area/space/room that contains the lights they are going to control. If this is not possible, a separate manual 'group modification' will be required to create the proper switch groups for each affected dimmer.

Once light fixtures and wall dimmers are installed and connected to properly configured network switches, they will receive power and IP addresses from the switches. LLDP negotiation allows the fixtures to turn on at full power output, but no control of the network will be available until the network is commissioned using the SmartCast Manager™ application.

SMARTCAST® MANAGER SETUP

SmartCast Manager™ provides the User Interface for the SmartCast® PoE network. It is supported in the following real or virtual computing environments with the listed hardware requirements.

Windows® 7 Professional / Enterprise	Intel Core i5 with 8 GB RAM Intel Core i7 with 16 GB RAM
Windows® 8.1 Professional	Intel Core i5 with 8 GB RAM
Windows® 10 Professional	Intel Core i5 with 8 GB RAM Intel Core i7 with 16 GB RAM
Windows® Server 2012 R2 SP1	Intel Xeon E5 with 8GB RAM

In order to ensure connectivity between the SmartCast Manager™ application and the SmartCast® lighting network, the following UDP ports must be opened for both outbound and inbound traffic in the firewall of the client PC on which SmartCast Manager™ has been installed. The installation of SmartCast Manager™ will attempt to open these ports, but third-party security systems may override this action.

UDP Ports: **55004, 55005, 55006, 55007, 55008**

To support LLDP and SNMP use in the SmartCast Manager™ the following services should be enabled on your host computer:

**SNMP Service, SNMP Trap,
Link Layer Topology Discovery Mapper**

ONEBUTTON™ SETUP

OneButton™ Setup enables automatic commissioning of devices through network creation, group assignment and daylight harvesting calibration.

ATTENTION: If SmartCast® PoE lighting is the principal lighting within the space, auxiliary lighting should be used during the calibration process to ensure minimum safe lighting is present. The auxiliary lighting should be turned on prior to the start of OneButton™ Setup and remain on until OneButton™ Setup is completed.

Two options for OneButton™ Setup are available:

All: Every available, unconfigured endpoint in the VLAN is commissioned.

Choose: Select which endpoints to join based on the switch port.

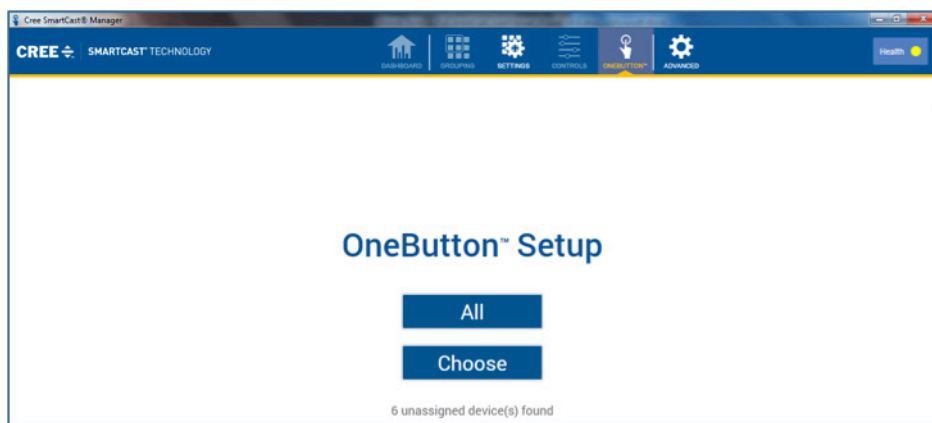


Figure 5. OneButton™ Setup

OneButton™ Setup consists of four phases:

1. **Find** As they are discovered, fixtures dim and wall dimmers blink their status LED four times.
2. **Calibrate** All fixtures that were found in Step #1 will toggle off and on once to learn about the available light within the space.
3. **Learn** Devices perform specific learning sequences in order to identify one another and the space in which they are installed.
4. **Group** Devices are intelligently grouped; energy-saving, code-compliant settings and operating modes are assigned.

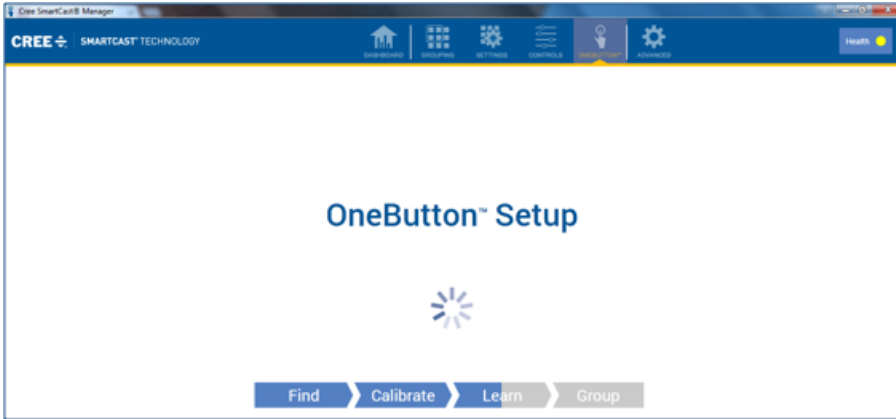


Figure 6. OneButton™ Setup in Progress

At the completion of OneButton™ Setup, the SmartCast Manager™ application reports the results of the process and begins tracking energy savings and power usage.

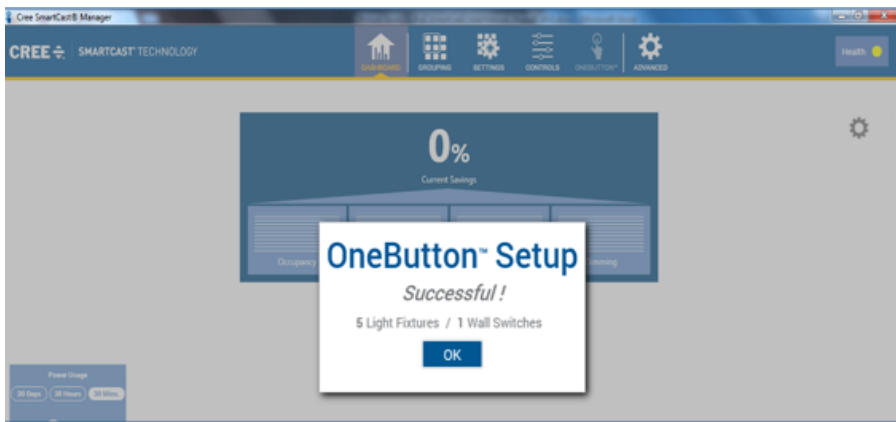


Figure 7. Successful OneButton™ Setup

SMARTCAST NORMAL MODES

SmartCast® PoE Technology uses two group types:

Occupancy Group: A group of fixtures can respond in a coordinated fashion to occupancy events and share settings for occupancy, task tuning and daylight harvesting.

Switch Group: A group of fixtures can be controlled in a coordinated fashion by one or more wall dimmers.

SmartCast® PoE Technology assigns California Title 24 2013 code-compliant settings for energy savings and operating modes as part of OneButton™ Setup.

SmartCast® PoE Technology uses three operating modes as defined below:

Occupancy Mode: This is the default mode when a wall dimmer is not present in a space. Fixtures will go to their Occupied Level (default: 100%) when motion is detected in a vacant space. Fixtures will go to their Unoccupied Level (default: 0%) when no motion is detected in an occupied space for longer than the Occupancy Timeout (default: 20 minutes).

Manual-On Mode Automatically selected when a wall dimmer is present in a space. Fixtures will not change light level when motion is detected in a vacant space. Fixtures will go to their Unoccupied Level (default: 0%) when no motion is detected in an occupied space for longer than the Occupancy Timeout (default: 20 minutes).

Auto-On Mode: Optional selection when a wall dimmer is present in the space. Fixtures will go to their Occupied Level (default: 100%) when motion is detected in a vacant space. The wall dimmer can manually turn the fixtures on or off, and can control the light level of the fixtures. Fixtures will go to their Unoccupied Level (default: 0%) when no motion is detected in an occupied space for longer than the Occupancy Timeout (default: 20 minutes).

USER CONFIGURATION

Groups can be manually configured to satisfy the requirements of an application using two selection methods: Point/Select or Browse/Select.

Point/Select: Allows devices to be selected by pressing wall dimmer buttons and using the light selection capabilities of the SmartCast® Configuration Tool.

Browse/Select: Allows devices to be selected by browsing and identifying devices and groups from within SmartCast Manager™.

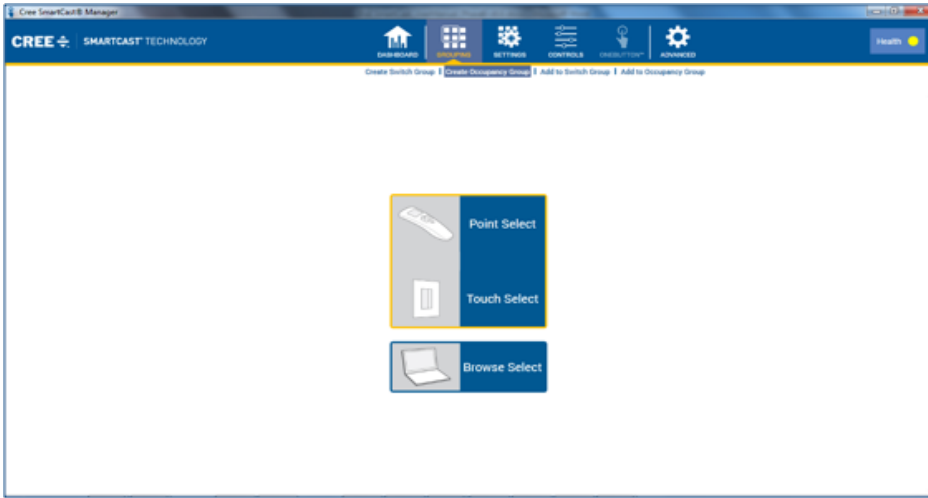


Figure 8. Group Modification creating a new Occupancy Group

SmartCast® PoE Technology assigns California Title 24 2013 code-compliant settings for energy savings at the completion of the OneButton™ Setup. The settings for Task Tuning and Daylight Harvesting can be viewed and edited in the Settings tab of the SmartCast Manager™ application and are described in detail in the SmartCast PoE User Manual.

SmartCast® PoE CR Series fixtures have the capability to adjust color temperature from 3000K to 5000K. This feature is accessible through the Controls page of SmartCast Manager™ where fixtures can be tuned individually or by group.

DEPLOYMENT FAQ

The following frequently asked questions should aid in the planning of a SmartCast® PoE Installation.

How many fixtures will a site require?

A lighting plan will be developed by the owners of the space to indicate the quantity of light fixtures and wall dimmers that are required as well as their installation points.

How many Cisco switches will be required for an installation?

Each fixture and wall dimmer in the lighting plan requires an Ethernet port. SmartCast Manager™ on a computer and SmartCast Link™ (if applicable) each require an Ethernet port within the VLAN. The sum of these ports will determine the number of Ethernet ports that will be required. Remember to take into account maximum switch power output when planning for switch quantity.

Where can network switches typically be installed?

The switches can be installed in a switch rack within a wiring closet when applying a centralized solution. When applying a distributed solution, the switches may be housed in wall-mounted racks or in plenum-rated ceiling racks. In each case, a patch panel should be installed for each switch to provide the best practice for cable routing.

How much AC power must be available to support the SmartCast® PoE installation?

SmartCast® PoE endpoints are DC powered fixtures. Each switch has two power supplies that convert AC power to DC power for the endpoints. AC source power must be available that meets the maximum load for the switch. Please consult the data sheets for the switch model to determine the power requirement for each switch. The power supplies of a Cisco® switch should be split between two AC circuits to provide redundancy protection.