



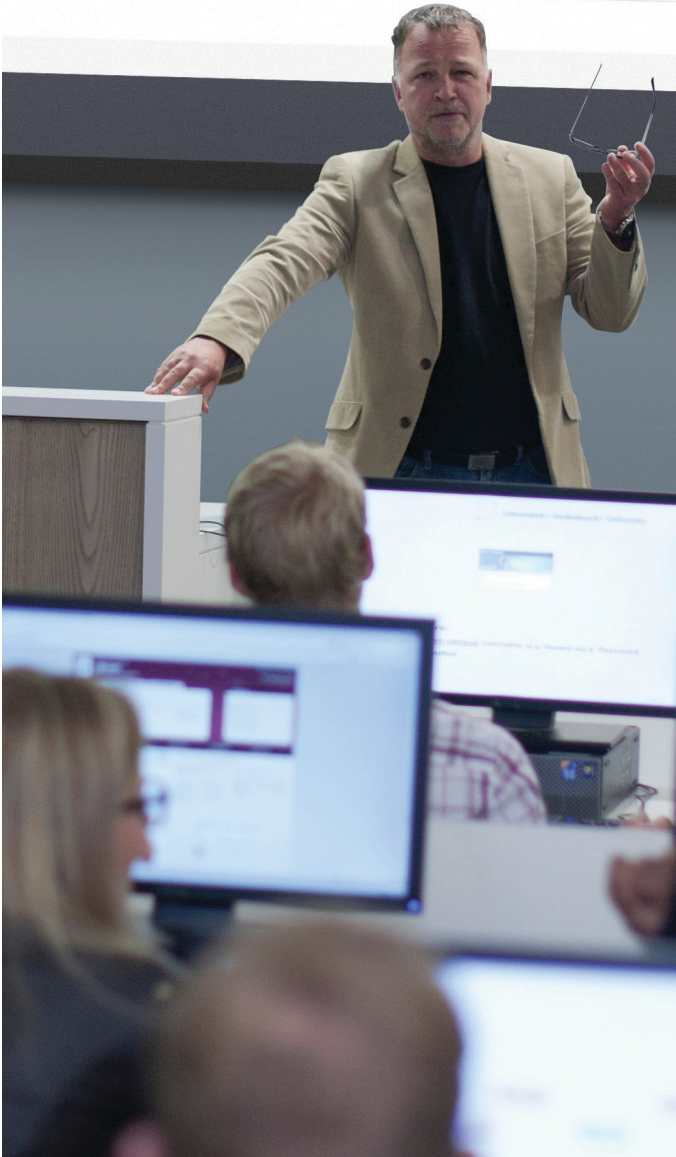
# Office Title 24-2016 Solutions

Design Guide  
Crestron Electronics, Inc.

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|                      | OIL                | COAL               | SOLAR         |
|----------------------|--------------------|--------------------|---------------|
| Temperate climates   | 2.50b              | 3.1b               | 0.25          |
| Subtropical climates | 1.23b              | 0.55b              | 1.18          |
| Arctic climates      | 0.09b              | 0.19b              | 3.73          |
| Continental climates | 1.15b              | 1.30b              | 2.21          |
|                      | 0.20b              | 0.82b              | 1.32          |
|                      | <b>Total: 5.17</b> | <b>Total: 5.96</b> | <b>Total:</b> |



## About Title 24-2016

Title 24-2016 is a residential and commercial building energy code that is designed to reduce energy consumption. The goal of this code is to reduce energy consumption by providing design and construction requirements for lighting controls.

Lighting controls such as occupancy status sensors, multi-level controls, and demand response provisions allow you to synchronize indoor light levels with daylight levels in accordance with Title 24-2016.

## Design Guide Information

Crestron offers this Design Guide for Office - Title 24-2016 solutions to use as a reference for typical layouts. Use it as guidance to make code compliance quick and easy. The Crestron team is also available to support with detailed design, submittal, and installation requirements. For additional information, please contact your Crestron representative at [CLCDesign@crestron.com](mailto:CLCDesign@crestron.com) or (888) 330-1502.

# Title 24-2016 Code Standards

## Summary

### Title 24-2016 Code Standards

|                     | Code Provision | Minimum Control Requirement        | Code Description   |
|---------------------|----------------|------------------------------------|--|
| ON/OFF CONTROLS     | 130.1(a)       | Local Manual Switch <sup>1</sup>   | Luminaires must be controlled with accessible manual on/off local control. Each space and area enclosed by ceiling-height partitions must be independently controlled.   |
|                     | 130.1(b)       | Multi-Level Control                | Lighting of any enclosed area 100 square feet or larger with more than one luminaire and a load >0.5 W per square foot should provide multi-level lighting control that meets uniformity requirements in accordance with Title24 Table 130.1-A. Lighting control can not override local on/off or any other control requirements.  |
|                     | 130.1(c)       | Shut-Off <sup>2</sup>              | Lighting must be controlled by either 1) an occupant sensing control, 2) automatic time-switch control with 2 hour maximum override and holiday scheduling, or 3) other control capable of automatically shutting off lighting. Indoor shut-off zones must be separated using ceiling high partitions and can be no larger than one floor with a maximum of 5,000 square feet. |
|                     | 130.1(c)5/6/7  | Sensor Shut-Off                    | Occupant Sensing Controls are required to shut off all lighting. Full or partial off to at least 50% via occupant sensing controls is required.  |
| LIGHT LEVEL CONTROL | 130.1(d)       | Daylight Zones <sup>3</sup>        | Automatic daylighting controls should be installed and configured in all daylit zones as defined by 130.1(d). Lighting controls should have multilevel functionality to at least the number of control steps defined in Title 24 Table 130.1-A.  |
|                     | 130.1(e)       | Demand Response Ready <sup>4</sup> | Buildings >10,000 square feet with a lighting power density ≥0.5 W per square foot are required to receive a standards-based messaging protocol, which automatically reduces lighting power by at least 15% and remains consistent with uniform illumination requirements defined in Title 24 Table 130.1-A.   |
| PLUG LOAD CONTROL   | 130.5(d)       | Controlled Receptacles             | 50% of receptacles are required to automatically turn off based on occupancy or after a vacancy of 20 minutes or less. Each uncontrolled receptacle must have at least one controlled receptacle within 6 feet.  |

#### Primary Solutions

Zūm™ Wireless Light Control

GLPP

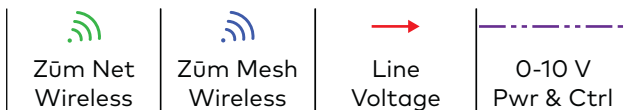
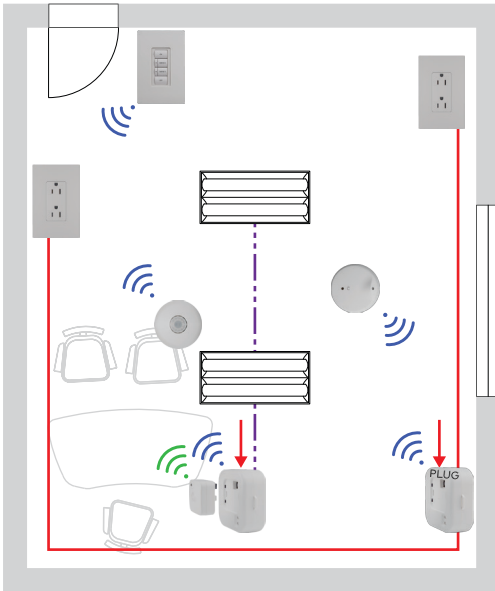
GLPAC

- General lighting must be separately controlled from all other lighting systems in an area. Floor and wall display, window display, case display, track, ornamental, and special effects lighting should be separately controlled and placed on circuits that are 20 amps or less.
- Countdown timer switches should not be used to comply with the automatic shut-off control requirements in Section 130.1(c)1, except in single-stall bathrooms and closets that are <70 square feet where the lights must shut off within ten minutes, or in a server aisle/room where the lights must shut off within 30 minutes.
- The photosensor should be readily accessible to authorized personnel for calibration adjustments. To prevent unauthorized access, the photosensor may be mounted inside a case that is secured with a locking mechanism.
- Add a networked Crestron control system for demand response (130.5(d)) control. For networked Zūm applications, add a ZUM-FLOOR-HUB and ZUMNET-GATEWAY for demand response.

|  |  | Space Type      |          |                 |
|--|--|-----------------|----------|-----------------|
| Small Private Office<br>≤250 square feet | Large or Open Office<br>>250 square feet | Public Restroom | Corridor | Conference Room |
| ✓  | ✓  | ✓               | ✓        | ✓               |
| ✓  | ✓  | ✓               | ✓        | ✓               |
| ✓  | ✓  | ✓               | ✓        | ✓               |
| ✓  |  |                 | ✓        | ✓               |
| ✓  | ✓  | ✓               | ✓        | ✓               |
| ✓  | ✓  | ✓               | ✓        | ✓               |
| ✓  | ✓  |                 |          | ✓               |
| ✓  | ✓  | ✓               | ✓        | ✓               |
| ✓  |  | ✓               | ✓        |                 |
|  | ✓  |                 |          | ✓               |

# Private Office Space / Huddle Space

Zūm™









## Title 24-2016 Code Compliance:

- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Sensor Shut-Off (130.1(c)5/6/7)
- ▶ Daylight Zones (130.1(d))
- ▶ Demand Response Ready (130.1(e))
- ▶ Controlled Receptacle (130.5(d))

## Local Control:

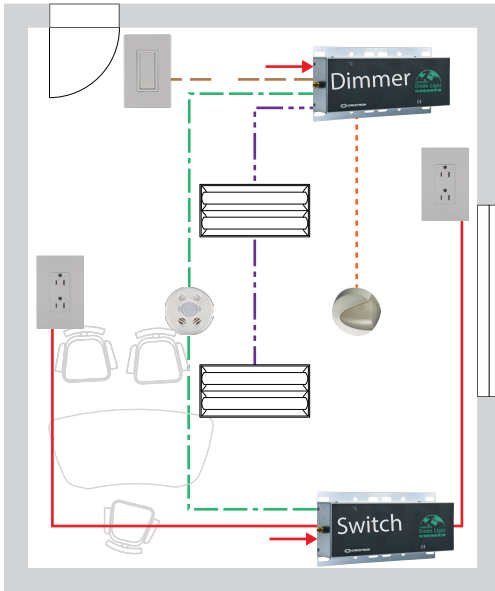


## GLZUM-1JBOX\_LV5A-1CKP\_BATT-1PIR\_BATT-1LDL-NET-1PS

| Symbol  | Qty. | Product                  | Description  |
|---|------|--------------------------|--|
|  | 1    | ZUMMESH-JBOX-5A-LV       | Zūm™ Junction Box Zone Controller, 0-10 V Dimming, 5 A |
|  | 1    | ZUMMESH-JBOX-20A-PLUG    | Zūm™ J-Box Load Controller, Plug Load Switch           |
|  | 1    | ZUMMESH-NETBRIDGE        | Zūm™ Network Bridge                                    |
|  | 1    | ZUMMESH-KP10CBATT        | 6-Button Battery Powered Keypad                        |
|  | 1    | ZUMMESH-PIR-VACANCY-BATT | PIR Vacancy Sensor (AUTO-OFF)                          |
|  | 1    | ZUMMESH-OL-PHOTOCELL     | Open Loop Daylight Sensor                              |

# Private Office Space / Huddle Space

## GLPP



## Title 24-2016 Code Compliance:

- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Sensor Shut-Off (130.1(c)5/6/7)
- ▶ Daylight Zones (130.1(d))
- ▶ Demand Response Ready (130.1(e))
- ▶ Controlled Receptacle (130.5(d))

## Local Control:

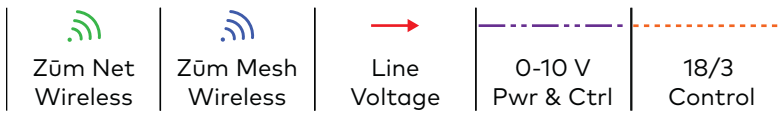
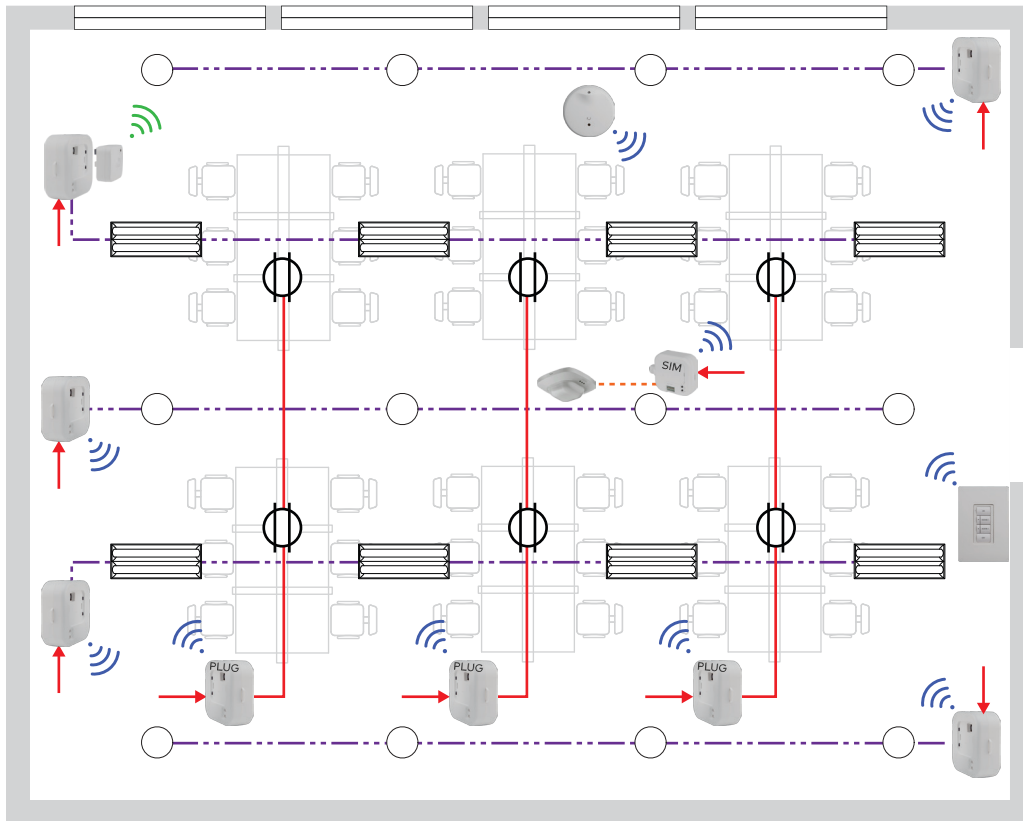


## GLPP-1DIM-JKP-1OS-LOL-NET-1PL

| Product | Qty. | Product          | Description  |
|---------|------|------------------|--|
|         | 1    | GLPP-DIMFLVCN-PM | 1-Ch 0-10 V Dimmer with Cresnet® Control                                 |
|         | 1    | GLPP-SWCN        | Crestron Green Light® Power Pack, 1-Channel Switch with Cresnet® Control |
|         | 1    | GLPPA-KP         | In-Wall Keypad for GLPP  |
|         | 1    | GLS-ODT-C-NS     | Dual-Technology Ceiling Mount Occupancy Sensor                           |
|         | 1    | GLS-LOL          | Crestron Green Light® Photosensor, Open-Loop                             |

# Open Office Space

Zūm™



▶ Use GLS-ODT-C-NS motion sensors to compensate for full height modular furniture in open office space.

## GLZUM-5JBOX\_LV5A-1CKP\_BATT-1QUAD-1LDL-NET-3PS

| Symbol | Qty. | Product                   | Description  |
|--------|------|---------------------------|--|
|        | 5    | ZUMMESH-JBOX-5A-LV        | Zūm™ Junction Box Zone Controller, 0-10 V Dimming, 5 A |
|        | 3    | ZUMMESH-JBOX-20A-PLUG     | Zūm™ J-Box Load Controller, Plug Load Switch           |
|        | 1    | ZUMMESH-JBOX-SIM          | Zūm™ Junction Box Sensor Integration Module            |
|        | 1    | ZUMMESH-NETBRIDGE         | Zūm™ Network Bridge                                    |
|        | 1    | ZUMMESH-KP10CBATT         | 6-Button Battery Powered Keypad                        |
|        | 1    | GLA-IR-QUATTRO-HD-COM1-24 | STEINEL IR Quattro HD COM1-24 Presence Detector        |
|        | 1    | ZUMMESH-OL-PHOTOCELL      | Open Loop Daylight Sensor                              |

## Title 24-2016 Code Compliance:

- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Sensor Shut-Off (130.1(c)5/6/7)
- ▶ Daylight Zones (130.1(d))
- ▶ Demand Response Ready (130.1(e))
- ▶ Controlled Receptacle (130.5(d))

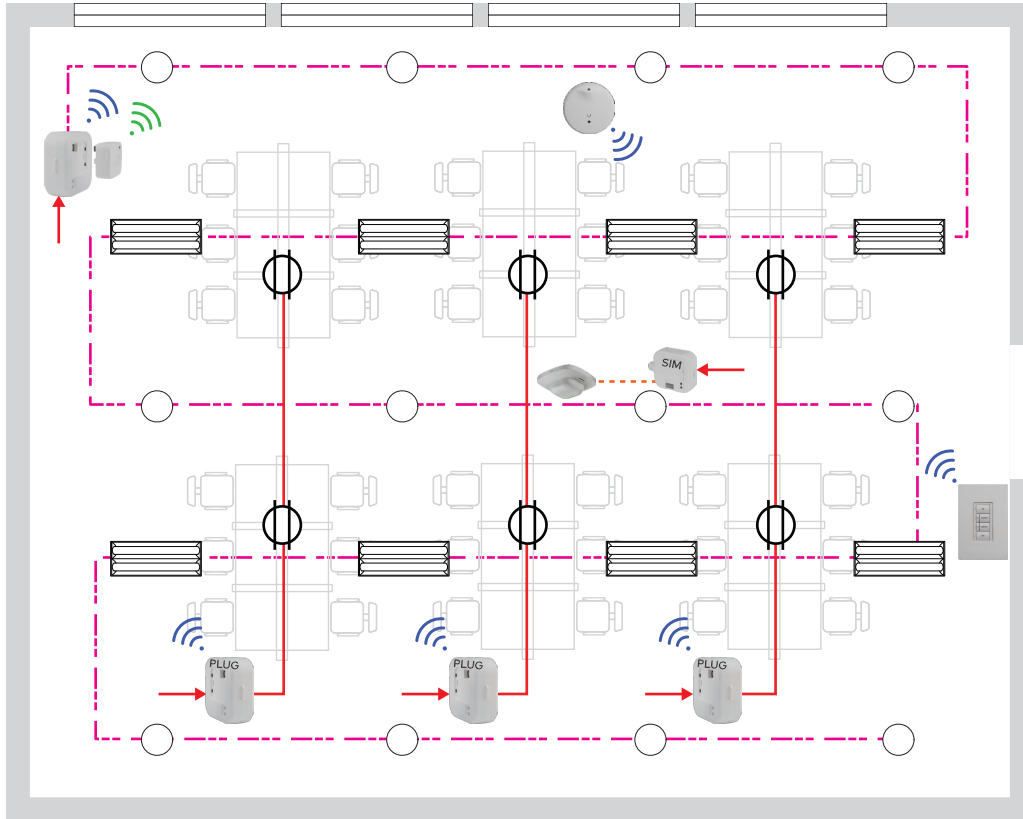
## Local Control:





# Open Office Space

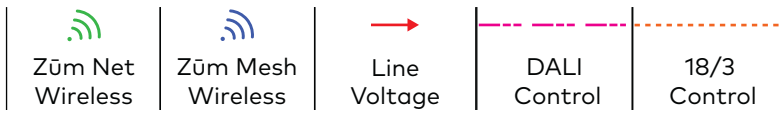
## Züm™ Control for DALI® Lighting



### Title 24-2016 Code Compliance:

- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Sensor Shut-Off (130.1(c)5/6/7)
- ▶ Daylight Zones (130.1(d))
- ▶ Demand Response Ready (130.1(e))
- ▶ Controlled Receptacle (130.5(d))

### Local Control:



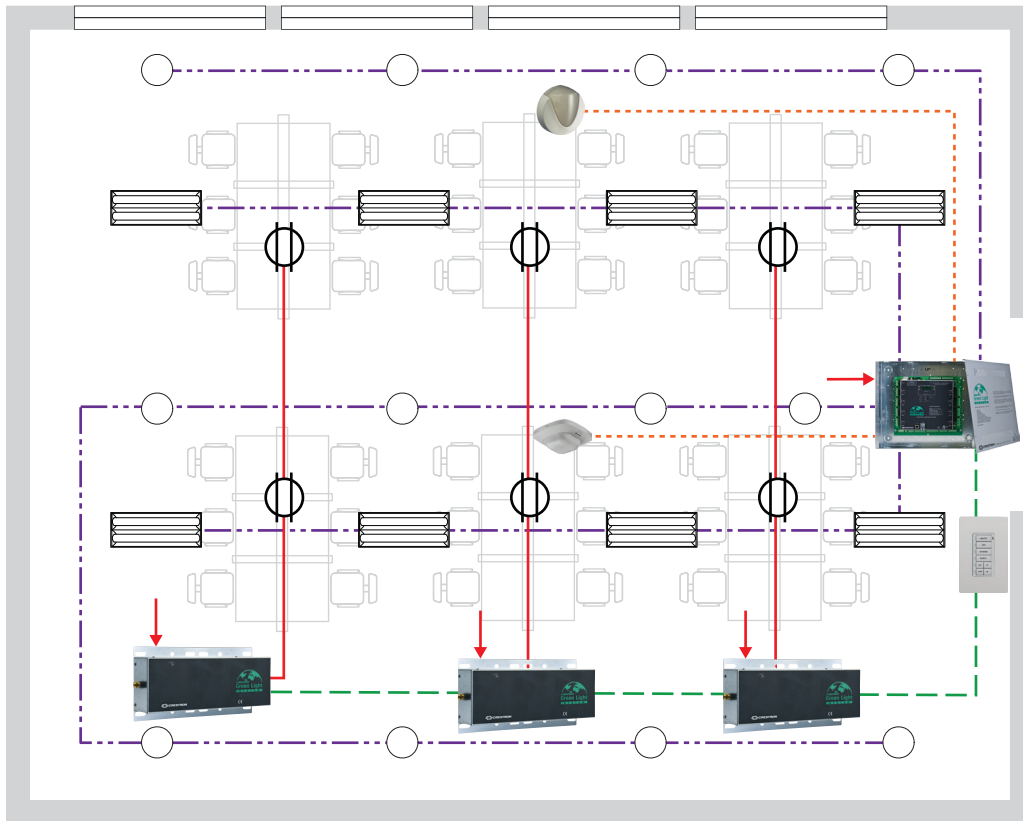
▶ Use GLS-ODT-C-NS motion sensors to compensate for full height modular furniture in open office space.

### GLZUM-1JBOX\_DALI-1CKP\_BATT-1QUAD-1LDL-NET-3PS

| Symbol | Qty. | Product                   | Description                                       |
|--------|------|---------------------------|---|
|        | 1    | ZUMMESH-JBOX-DALI         | Züm™ Junction Box Zone Controller, DALI® Lighting |
|        | 3    | ZUMMESH-JBOX-20A-PLUG     | Züm™ J-Box Load Controller, Plug Load Switch      |
|        | 1    | ZUMMESH-JBOX-SIM          | Züm™ Junction Box Sensor Integration Module       |
|        | 1    | ZUMMESH-NETBRIDGE         | Züm™ Network Bridge                               |
|        | 1    | ZUMMESH-KP10CBATT         | 6-Button Battery Powered Keypad                   |
|        | 1    | GLA-IR-QUATTRO-HD-COM1-24 | STEINEL IR Quattro HD COM1-24 Presence Detector   |
|        | 1    | ZUMMESH-OL-PHOTOCELL      | Open Loop Daylight Sensor                         |

# Open Office Space

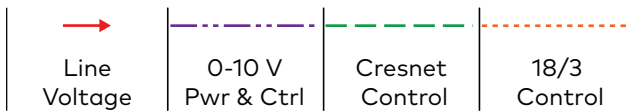
## GLPAC



### Title 24-2016 Code Compliance:






- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Sensor Shut-Off (130.1(c)5/6/7)
- ▶ Daylight Zones (130.1(d))
- ▶ Demand Response Ready (130.1(e))
- ▶ Controlled Receptacle (130.5(d))

### Local Control:



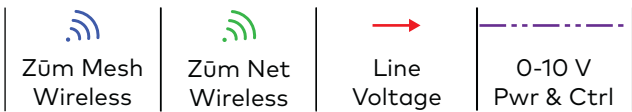
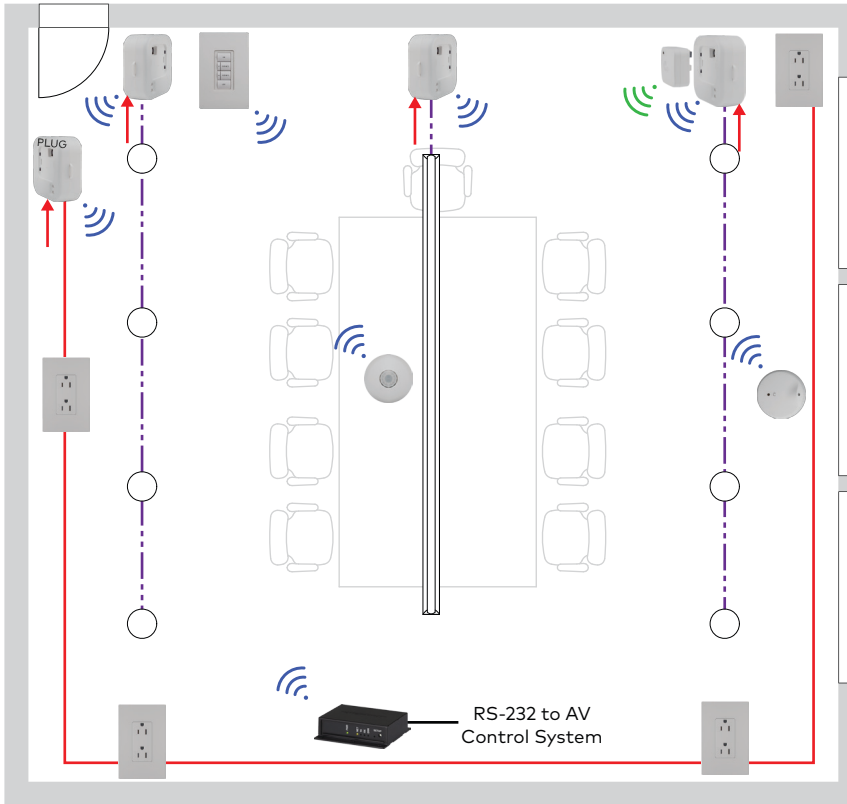
▶ Use GLS-ODT-C-NS motion sensors to compensate for full height modular furniture in open office space.

### GLPAC-4-XKP-1QUAD-1LOL-NET-3PL

| Symbol  | Qty. | Product                   | Description   |
|---|------|---------------------------|---|
|  | 1    | GLPAC-DIMFLV4             | Crestron Green Light® Integrated Lighting System, 4-Channel       |
|  | 3    | GLPP-SWCN                 | Crestron Green Light® Power Pack, 1-Channel with Cresnet® Control |
|  | 1    | C2N-CBD-P                 | Cameo® Keypad, Standard Mount                                     |
|  | 1    | GLA-IR-QUATTRO-HD-COM1-24 | STEINEL IR Quattro HD COM1-24 Presence Detector                   |
|  | 1    | GLS-LOL                   | Crestron Green Light® Photosensor, Open-Loop                      |

# Conference Room

Zūm™



## Title 24-2016 Code Compliance:

- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Sensor Shut-Off (130.1(c)5/6/7)
- ▶ Daylight Zones (130.1(d))
- ▶ Demand Response Ready (130.1(e))
- ▶ Controlled Receptacle (130.5(d))

## Local Control:

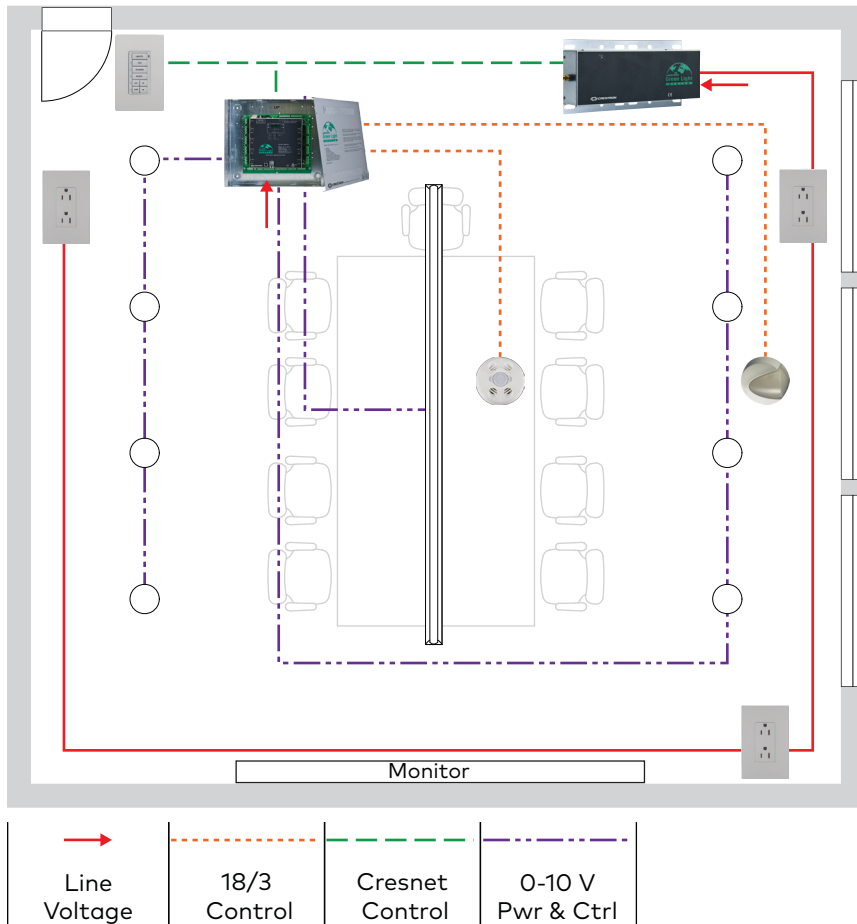


## GLZUM-3JBOX\_LV5A-1CKP\_BATT-1PIR\_BATT-1LDL-AV-NET-1PS

| Symbol | Qty. | Product                  | Description  |
|--------|------|--------------------------|--|
|        | 3    | ZUMMESH-JBOX-5A-LV       | Zūm™ Junction Box Zone Controller, 0-10 V Dimming, 5 A |
|        | 1    | ZUMMESH-JBOX-20A-PLUG    | Zūm™ J-Box Load Controller, Plug Load Switch           |
|        | 1    | ZUMMESH-NETBRIDGE        | Zūm™ Network Bridge                                    |
|        | 1    | ZUMMESH-AVBRIDGE         | AV Bridge – Wireless Control Integration Module        |
|        | 1    | ZUMMESH-KP10CBATT        | 6-Button Battery Powered Keypad                        |
|        | 1    | ZUMMESH-PIR-VACANCY-BATT | PIR Vacancy Sensor (AUTO-OFF)                          |
|        | 1    | ZUMMESH-OL-PHOTOCELL     | Open Loop Daylight Sensor                              |

# Conference Room

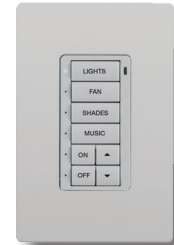
## GLPAC



### Title 24-2016 Code Compliance:

- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Sensor Shut-Off (130.1(c)5/6/7)
- ▶ Daylight Zones (130.1(d))
- ▶ Demand Response Ready (130.1(e))
- ▶ Controlled Receptacle (130.5(d))

### Local Control:

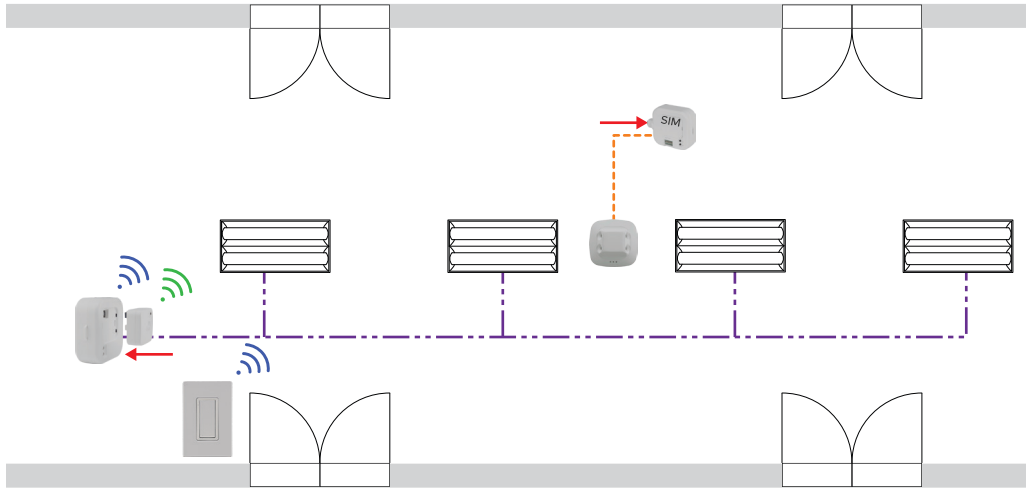


### GLPAC-4-XKP-10S-NET-1PL

| Symbol | Qty. | Product       | Description  |
|--------|------|---------------|--|
|        | 1    | GLPAC-DIMFLV4 | Crestron Green Light® Integrated Lighting System, 4-Channel              |
|        | 1    | GLPP-SWCN     | Crestron Green Light® Power Pack, 1-Channel Switch with Cresnet® Control |
|        | 1    | C2N-CBD-P     | Cameo® Keypad, Standard Mount  |
|        | 1    | GLS-ODT-C-NS  | Dual-Technology Ceiling Mount Occupancy Sensor                           |
|        | 1    | GLS-LOL       | Crestron Green Light® Photosensor, Open-Loop                             |

# Corridor

## Zūm™

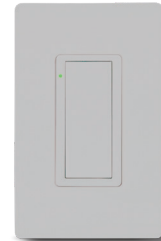


- ▶ UL924 emergency lighting devices are available for life safety.
- ▶ Daylight zones (130.1(d)) may be required if windows are present.
- ▶ Lighting installed in a corridor should meet the following requirements in addition to complying with Section 130.1(c)1: The corridor should be controlled by occupant sensing controls that separately reduce the lighting power by at least 50% when the corridor is unoccupied. The occupant sensing controls should be capable of automatically turning the lighting fully on only in the separately controlled corridor, and should be automatically activated from all designed paths of egress.
- ▶ Lighting installed in a common area corridor that provides access to guest rooms and dwelling units should comply with 130.1(c)7: Common area corridors must be controlled with occupant sensing controls that automatically reduce lighting power in unoccupied areas by at least 50%. The occupant sensing controls should be capable of automatically turning the lighting fully on only in the separately controlled corridor, and should be automatically activated from all designed paths of egress. When the installed lighting power is 80% or less of the value allowed under the Area Category Method, occupant sensing controls should reduce the power by at least 40%.

## Title 24-2016 Code Compliance:

- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Sensor Shut-Off (130.1(c)5/6/7)
- ▶ Demand Response Ready (130.1(e))

## Local Control:

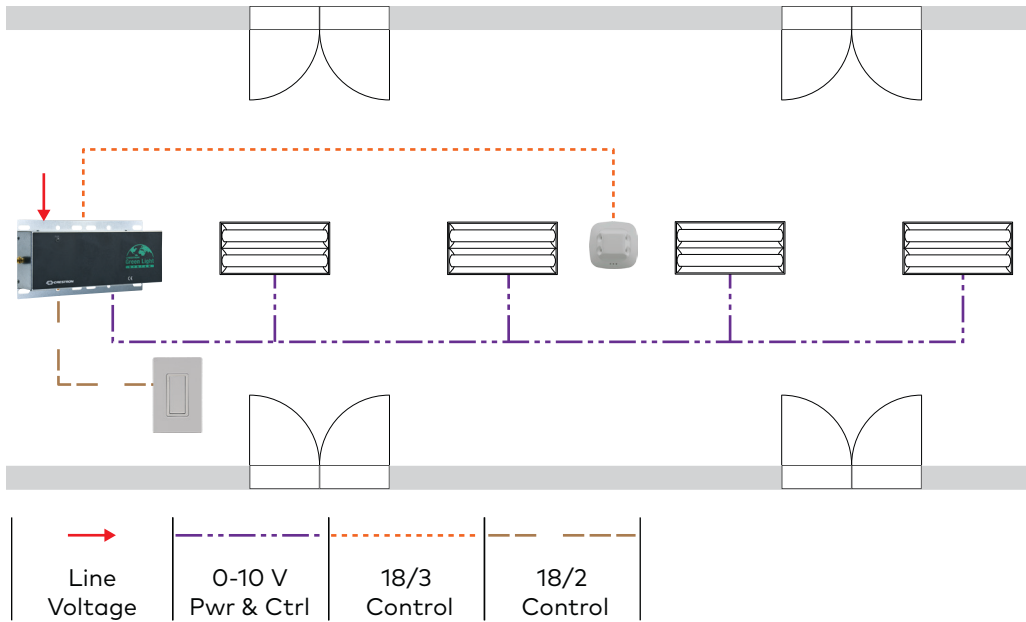


## GLZUM-1JBOX\_LV5A-1AKP\_BATT-HALL\_US1-NET

| Symbol | Qty. | Product                | Description   |
|--------|------|------------------------|---|
|        | 1    | ZUMMESH-JBOX-5A-LV     | Zūm™ Junction Box Zone Controller, 0-10 V Dimming, 5 A                              |
|        | 1    | ZUMMESH-JBOX-SIM       | Zūm™ Junction Box Sensor Integration Module   |
|        | 1    | ZUMMESH-NETBRIDGE      | Zūm™ Network Bridge   |
|        | 1    | ZUMMESH-KP10ABATT      | Rocker-Button Battery Powered Keypad  |
|        | 1    | GLA-US-HALLWAY-COM1-24 | 40 kHz Ultrasonic Presence Detector, Ceiling Mount, Hallway Coverage, 18-24 VAC/VDC |

# Corridor

## GLPP



### Title 24-2016 Code Compliance:




- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Sensor Shut-Off (130.1(c)5/6/7)
- ▶ Demand Response Ready (130.1(e))

- ▶ UL924 emergency lighting devices are available for life safety.
- ▶ Daylight zones (130.1(d)) may be required if windows are present.
- ▶ Lighting installed in a corridor should meet the following requirements in addition to complying with Section 130.1(c)1: The corridor should be controlled by occupant sensing controls that separately reduce the lighting power by at least 50% when the corridor is unoccupied. The occupant sensing controls should be capable of automatically turning the lighting fully on only in the separately controlled corridor, and should be automatically activated from all designed paths of egress.
- ▶ Lighting installed in a common area corridor that provides access to guest rooms and dwelling units should comply with 130.1(c)7: Common area corridors must be controlled with occupant sensing controls that automatically reduce lighting power in unoccupied areas by at least 50%. The occupant sensing controls should be capable of automatically turning the lighting fully on only in the separately controlled corridor, and should be automatically activated from all designed paths of egress. When the installed lighting power is 80% or less of the value allowed under the Area Category Method, occupant sensing controls should reduce the power by at least 40%.

### Local Control:

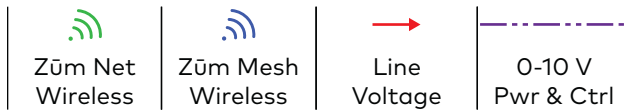
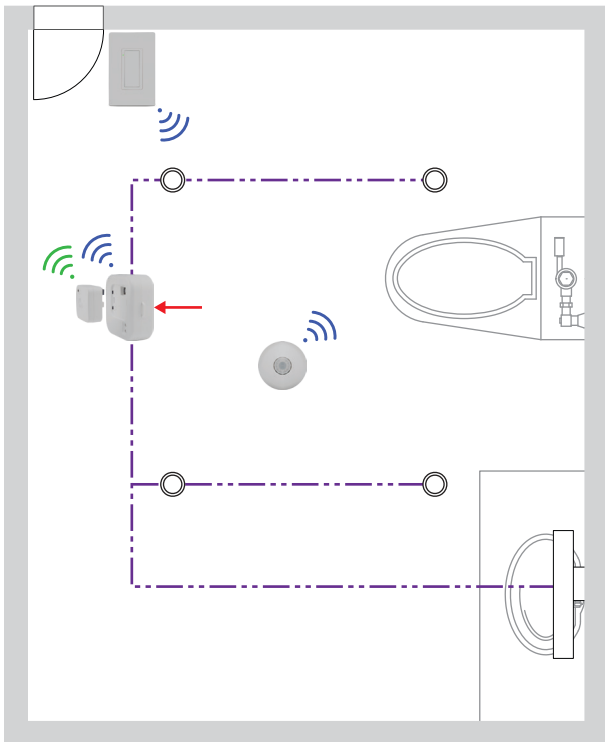


### GLPP-1 1DIM-JKP-HALL\_US1-NET

| Product   | Qty. | Product                | Description   |
|---|------|------------------------|---|
|  | 1    | GLPP-1DIMFLVCN-PM      | 1-Ch 0-10 V Dimmer with Cresnet® Control  |
|  | 1    | GLPPA-KP               | In-Wall Keypad for GLPP   |
|  | 1    | GLA-US-HALLWAY-COM1-24 | 40 kHz Ultrasonic Presence Detector, Ceiling Mount, Hallway Coverage, 18-24 VAC/VDC |

# Private Restroom

Zūm™



► Daylight zones (130.1(d)) may be required if windows are present.





## Title 24-2016 Code Compliance:

- Local Manual Switch (130.1(a))
- Multi-Level Control (130.1(b))
- Shut-Off (130.1(c))
- Daylight Zones (130.1(d))
- Demand Response Ready (130.1(e))

## Local Control:

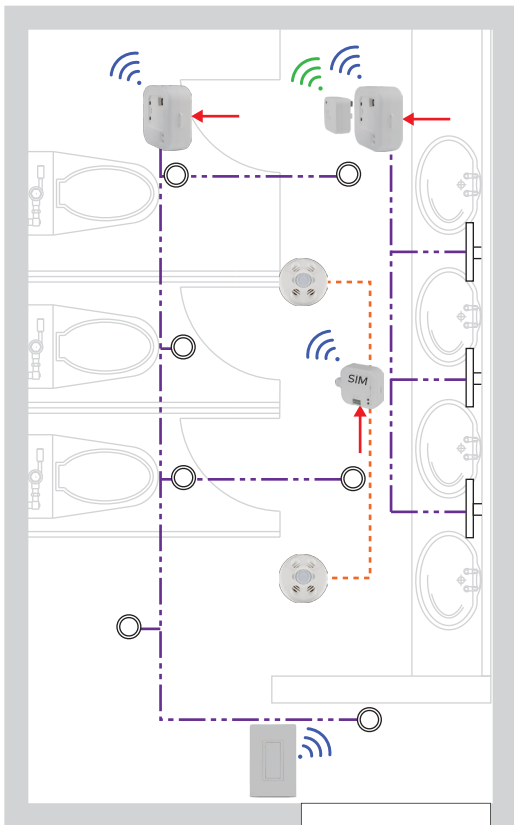


## GLZUM-1JBOX\_LV5A-1BKP\_BATT-1PIR\_BATT-NET

| Symbol  | Qty. | Product                  | Description  |
|---|------|--------------------------|--|
|  | 1    | ZUMMESH-JBOX-5A-LV       | Zūm™ Junction Box Zone Controller, 0-10 V Dimming, 5 A |
|  | 1    | ZUMMESH-NETBRIDGE        | Zūm™ Network Bridge                                    |
|  | 1    | ZUMMESH-KP10ABATT        | Rocker-Button Battery Powered Keypad                   |
|  | 1    | ZUMMESH-PIR-VACANCY-BATT | PIR Vacancy Sensor (AUTO-OFF)                          |

# Public Restroom

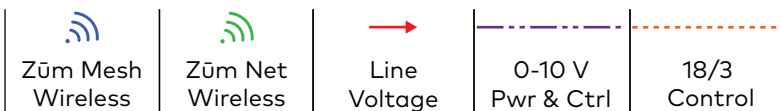
Zūm™



## Title 24-2016 Code Compliance:






- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Daylight Zones (130.1(d))
- ▶ Demand Response Ready (130.1(e))

## Local Control:



- ▶ Public restrooms with two or more stalls may use a manual control not accessible to unauthorized personnel.
- ▶ Daylight zones (130.1(d)) may be required if windows are present.
- ▶ Public restrooms should have at least one control step between 30-70% of full rated power.

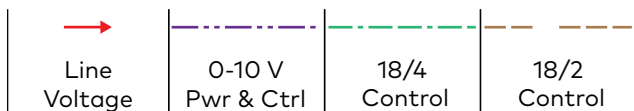
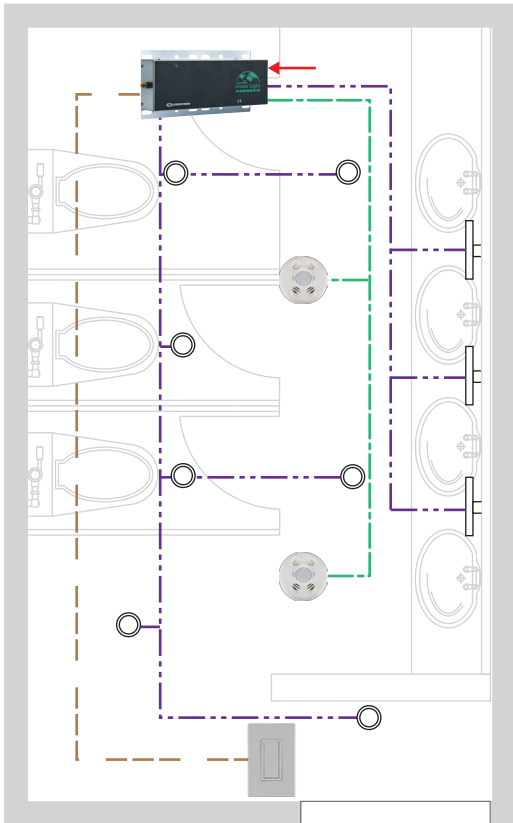
## GLZUM-2JBOX\_LV5A-AKP\_BATT-2OS-NET

| Symbol  | Qty. | Product            | Description  |
|---|------|--------------------|--|
|  | 2    | ZUMMESH-JBOX-5A-LV | Zūm™ Junction Box Zone Controller, 0-10 V Dimming, 5 A |
|  | 1    | ZUMMESH-JBOX-SIM   | Zūm™ Junction Box Sensor Integration Module            |
|  | 1    | ZUMMESH-NETBRIDGE  | Zūm™ Network Bridge                                    |
|  | 1    | ZUMMESH-KP10ABATT  | Rocker-Button Battery Powered Keypad                   |
|  | 2    | GLS-ODT-C-NS       | Dual-Technology Ceiling Mount Occupancy Sensor         |






# Public Restroom

## GLPP



- ▶ Public restrooms with two or more stalls may use a manual control not accessible to unauthorized personnel.
- ▶ Daylight zones (130.1(d)) may be required if windows are present.
- ▶ Public restrooms should have at least one control step between 30-70% of full rated power.

### GLPP-1 2DIM-JKP-2OS-NET

| Product   | Qty. | Product            | Description                                    |
|---|------|--------------------|--|
|  | 1    | GLPP-1DIMFLV2CN-PM | 2-Ch 0-10 V Dimmer with Cresnet® Control       |
|  | 1    | GLPPA-KP           | In-Wall Keypad for GLPP                        |
|  | 2    | GLS-ODT-C-NS       | Dual-Technology Ceiling Mount Occupancy Sensor |

## Title 24-2016 Code Compliance:

- ▶ Local Manual Switch (130.1(a))
- ▶ Multi-Level Control (130.1(b))
- ▶ Shut-Off (130.1(c))
- ▶ Daylight Zones (130.1(d))
- ▶ Demand Response Ready (130.1(e))

## Local Control:





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