Contents

About ASHRAE 90.1-2016 ................................. 1

Design Guide Information ................................ 1

ASHRAE 90.1-2016 Code Standards .................. 2

Private Office Space / Huddle Space .................. 4
   Züm................................................................................. 4
   GLPP............................................................................. 5

Open Office Space ............................................. 6
   Züm............................................................................. 6
   GLPAC........................................................................ 7

Conference Room ............................................. 8
   Züm............................................................................. 8
   GLPAC........................................................................ 9

Corridor .......................................................... 10
   Züm.......................................................................... 10
   GLPP.......................................................................... 11

Private Restroom ............................................. 12
   Züm.......................................................................... 12
   Steinel ....................................................................... 13

Public Restroom .............................................. 14
   Züm.......................................................................... 14
   GLPP.......................................................................... 15
About ASHRAE 90.1-2016

ASHRAE 90.1-2016 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 ASHRAE 90.1-2016.

Design Guide Information

Crestron® offers this Design Guide for Office - ASHRAE 90.1-2016 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 or (888) 330-1502.
## ASHRAE 90.1-2016 Code Standards

### Summary

<table>
<thead>
<tr>
<th>Code Provision</th>
<th>Minimum Control Requirement</th>
<th>Code Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.4.1.1</td>
<td>Automatic Full On (Occupancy Sensing Mode)</td>
<td>Lighting is permitted to automatically turn to full on.</td>
</tr>
<tr>
<td>9.4.1.1.a</td>
<td>Local Control</td>
<td>There should be one or more readily accessible manual lighting controls in each space.</td>
</tr>
<tr>
<td>9.4.1.1.b/c</td>
<td>Manual On / Partial Auto On (Vacancy Sensing Mode)</td>
<td>The general lighting can be manually turned on or automatically turned on up to 50%.</td>
</tr>
<tr>
<td>9.4.1.1.g</td>
<td>Automatic Partial Off</td>
<td>Lighting power should be automatically reduced by at least 50% within 20 minutes of vacancy.</td>
</tr>
<tr>
<td>9.4.1.1.h</td>
<td>Automatic Full Off</td>
<td>All lighting must be shut off within 20 minutes of vacancy.</td>
</tr>
<tr>
<td>9.4.1.1.i</td>
<td>Scheduled Shutoff (Programmable Timeclock)</td>
<td>All lighting should be automatically shut off during periods when the space is scheduled to be unoccupied using a programmable timeclock or signal from another control device (i.e. security system).</td>
</tr>
<tr>
<td>9.4.1.1.d</td>
<td>Bi-level Control (0-10v Dimming)</td>
<td>The general lighting should use continuous dimming or have at least one intermediate step between 30-70% power in addition to full on and full off.</td>
</tr>
<tr>
<td>9.4.1.1.e/f</td>
<td>Automatic Daylight Control (Photocontrol)</td>
<td>In primary side daylit general lighting zones using more than 150W (or using more than 300W within the primary and secondary daylit zones), daylight must be harvested using photocontrols. In top daylit general lighting zones using more than 150W, daylight must be harvested using photocontrols.</td>
</tr>
<tr>
<td>8.4.2</td>
<td>Automatic Receptacle Control</td>
<td>50% of all receptacles and 25% of modular furniture feeders must be turned off 20 minutes after vacancy.</td>
</tr>
</tbody>
</table>

**Primary Solutions**

- Züm™ Wireless Light Control
- GLPP
- GLPAC
- Steinel

* Optional
** Lighting in open-plan office spaces can be allowed to turn on automatically to more than 50%, as long as the control zone is no larger than 600 sq. ft.
*** 9.4.1.1.g permits automatic partial off so that lighting can be automatically reduced by at least 50% (“night light” mode). Full off is also acceptable.
<table>
<thead>
<tr>
<th>Space Type</th>
<th>Private Office/Huddle Space ≤250 sq. ft.</th>
<th>Open Office Space/Large Private Office ≥250 sq. ft.</th>
<th>Conference Room</th>
<th>Corridor</th>
<th>Restroom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Optional
** Lighting in open-plan office spaces can be allowed to turn on automatically to more than 50%, as long as the control zone is no larger than 600 sq. ft.
*** 9.4.1.1.g permits automatic partial off so that lighting can be automatically reduced by at least 50% (“night light” mode). Full off is also acceptable.
Private Office Space / Huddle Space

Zūm

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

ASHRAE 90.1-2016 Code Compliance:

- Local Control (9.4.1.1.a)
- Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- Automatic Full Off (9.4.1.1.h)
- Bi-level Control (0-10V Dimming) (9.4.1.1.d)
- Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- Automatic Receptacle Control (8.4.2)

Local Control:
Private Office Space / Huddle Space

GLPP

<table>
<thead>
<tr>
<th>Line Voltage</th>
<th>0-10 V Pwr &amp; Ctrl</th>
<th>18/2 Control</th>
<th>18/3 Control</th>
<th>18/4 Control</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Product</th>
<th>Qty.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Dimmer" /></td>
<td>1</td>
<td>GLPP-DIMFLVCN-PM</td>
<td>1-Ch 0-10V Dimmer with Cresnet® Control</td>
</tr>
<tr>
<td><img src="image" alt="Switch" /></td>
<td>1</td>
<td>GLPP-SWCN</td>
<td>Crestron Green Light® Power Pack, 1-Channel Switch with Cresnet® Control</td>
</tr>
<tr>
<td><img src="image" alt="In-Wall Keypad" /></td>
<td>1</td>
<td>GLPPA-KP</td>
<td>In-Wall Keypad for GLPP</td>
</tr>
<tr>
<td><img src="image" alt="Occupancy Sensor" /></td>
<td>1</td>
<td>GLS-ODT-C-NS</td>
<td>Dual-Technology Ceiling Mount Occupancy Sensor</td>
</tr>
<tr>
<td><img src="image" alt="Photosensor" /></td>
<td>1</td>
<td>GLS-LOL</td>
<td>Crestron Green Light® Photosensor, Open-Loop</td>
</tr>
</tbody>
</table>

**ASHRAE 90.1-2016 Code Compliance:**

- Local Control (9.4.1.1.a)
- Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- Automatic Full Off (9.4.1.1.h)
- Bi-level Control (0-10v Dimming) (9.4.1.1.d)
- Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- Automatic Receptacle Control (8.4.2)

**Local Control:**

1. ![Local Control Icon](image)
Open Office Space

Zūm

Use Crestron GLS-ODT-C-NS motion sensors when full height modular furniture is present in an open office space.

Add a ZUM-FLOOR-HUB and ZUMNET-GATEWAY for scheduled shutoff (9.4.1.1.i).

Symbol | Qty. | Product | Description
--- | --- | --- | ---
[Image] | 5 | ZUMMESH-JBOX-5A-LV | Zūm™ Junction Box Zone Controller, 0-10V Dimming, 5A
[Image] | 3 | ZUMMESH-JBOX-20A-PLUG | Zūm™ J-Box Load Controller, Plug Load Switch
[Image] | 1 | ZUMMESH-JBOX-SIM | Zūm™ Junction Box Sensor Integration Module
[Image] | 1 | ZUMMESH-NETBRIDGE | Zūm™ Network Bridge
[Image] | 1 | ZUMMESH-KP10CBATT | 6-Button Battery Powered Keypad
[Image] | 1 | GLS-LOL | Crestron Green Light® Photosensor, Open-Loop

ASHTAE 90.1-2016 Code Compliance:

- Local Control (9.4.1.1.a)
- Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- Automatic Full Off (9.4.1.1.h)
- Bi-level Control (0-10v Dimming) (9.4.1.1.d)
- Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- Automatic Receptacle Control (8.4.2)

Local Control:

- Use Crestron GLS-ODT-C-NS motion sensors when full height modular furniture is present in an open office space.
- Add a ZUM-FLOOR-HUB and ZUMNET-GATEWAY for scheduled shutoff (9.4.1.1.i).
Open Office Space

GLPAC

- Use Crestron GLS-ODT-C-NS motion sensors when full height modular furniture is present in an open office space.
- Motion sensing or time clock can be used to shut the lights off.

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

---

**ASHRAE 90.1-2016 Code Compliance:**

- Local Control (9.4.1.1.a)
- Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- Automatic Full Off (9.4.1.1.h)
- Scheduled Shutoff (Programmable Timeclock) (9.4.1.1.i)
- Bi-level Control (0-10v Dimming) (9.4.1.1.d)
- Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- Automatic Receptacle Control (8.4.2)

**Local Control:**

- Line Voltage
- 0-10 V Pwr & Ctrl
- Cresnet Control
- 18/3 Control
Conference Room

Zūm

ASHTAE 90.1-2016
Code Compliance:

- Local Control (9.4.1.1.a)
- Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- Automatic Full Off (9.4.1.1.h)
- Bi-level Control (0-10v Dimming) (9.4.1.1.d)
- Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- Automatic Receptacle Control (8.4.2)

Local Control:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Qty.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Symbol 1]</td>
<td>3</td>
<td>ZUMMESH-JBOX-5A-LV</td>
<td>Zūm™ Junction Box Zone Controller, 0-10V Dimming, 5A</td>
</tr>
<tr>
<td>![Symbol 2]</td>
<td>1</td>
<td>ZUMMESH-JBOX-20A-PLUG</td>
<td>Zūm™ J-Box Load Controller, Plug Load Switch</td>
</tr>
<tr>
<td>![Symbol 3]</td>
<td>1</td>
<td>ZUMMESH-NETBRIDGE</td>
<td>Zūm™ Network Bridge</td>
</tr>
<tr>
<td>![Symbol 4]</td>
<td>1</td>
<td>ZUMMESH-AVBRIDGE</td>
<td>AV Bridge – Wireless Control Integration Module</td>
</tr>
<tr>
<td>![Symbol 5]</td>
<td>1</td>
<td>ZUMMESH-KP10CBATT</td>
<td>6-Button Battery Powered Keypad</td>
</tr>
<tr>
<td>![Symbol 6]</td>
<td>1</td>
<td>ZUMMESH-PIR-VACANCY-BATT</td>
<td>PIR Vacancy Sensor (AUTO-OFF)</td>
</tr>
<tr>
<td>![Symbol 7]</td>
<td>1</td>
<td>ZUMMESH-OL-PHOTOCELL</td>
<td>Open Loop Daylight Sensor</td>
</tr>
</tbody>
</table>
Conference Room

GLPAC

ASHRAE 90.1-2016 Code Compliance:

- Local Control (9.4.1.1.a)
- Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- Automatic Full Off (9.4.1.1.h)
- Bi-level Control (0-10V Dimming) (9.4.1.1.d)
- Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- Automatic Receptacle Control (8.4.2)

Motion sensing or time clock can be used to shut the lights off.

Local Control:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Qty.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>GLPAC-DIMFLV4</td>
<td>Crestron Green Light® Integrated Lighting System, 4-Channel</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>GLPP-SWCN</td>
<td>Crestron Green Light® Power Pack, 1-Channel Switch with Cresnet® Control</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>C2N-CBD-P</td>
<td>Cameo® Keypad, Standard Mount</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>GLS-ODT-C-NS</td>
<td>Dual-Technology Ceiling Mount Occupancy Sensor</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>GLS-LOL</td>
<td>Crestron Green Light® Photosensor, Open-Loop</td>
</tr>
</tbody>
</table>
UL924 emergency lighting devices are available for life safety.

Add a ZUM-FLOOR-HUB and ZUMNET-GATEWAY for scheduled shutoff (9.4.1.1.i).

Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

### Local Control:

- **Automatic Full On** (Occupancy Sensing Mode) (9.4.1.1)
- **Local Control** (9.4.1.1.a)
- **Automatic Partial Off** (9.4.1.1.g)
- **Automatic Full Off** (9.4.1.1.h)

### Symbol | Qty. | Product | Description
--- | --- | --- | ---
| | 1 | ZUMMESH-JBOX-5A-LV | Zūm™ Junction Box Zone Controller, 0-10V Dimming, 5A
| | 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, 33 ft corridor coverage, up to 8 hallway sensors per SIM
Corridor

GLPP

ASHRAE 90.1-2016
Code Compliance:

- Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- Local Control (9.4.1.1.a)
- Automatic Partial Off (9.4.1.1.g)
- Automatic Full Off (9.4.1.1.h)

UL924 emergency lighting devices are available for life safety.
Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

Local Control:

<table>
<thead>
<tr>
<th>Product</th>
<th>Qty.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="GLPP-1DIMFLVCN-PM" /></td>
<td>1</td>
<td>GLPP-1DIMFLVCN-PM</td>
<td>1-Ch 0-10V Dimmer with Cresnet® Control</td>
</tr>
<tr>
<td><img src="image" alt="GLPPA-KP" /></td>
<td>1</td>
<td>GLPPA-KP</td>
<td>In-Wall Keypad for GLPP</td>
</tr>
<tr>
<td><img src="image" alt="GLA-US-HALLWAY-COM1-24" /></td>
<td>1</td>
<td>GLA-US-HALLWAY-COM1-24</td>
<td>40 kHz Ultrasonic Presence Detector, Ceiling Mount, Hallway Coverage, 18-24 VAC/VDC</td>
</tr>
</tbody>
</table>
Private Restroom

Zūm

ASHRAE 90.1-2016
Code Compliance:

- Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- Local Control (9.4.1.1.a)
- Automatic Full Off (9.4.1.1.h)

Local Control:

- Local control (9.4.1.1.a) is optional.
- Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Qty.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>1</td>
<td>ZUMMESH-5A-SW</td>
<td>Zūm™ Wall-Box Switch, 5A</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>1</td>
<td>ZUMMESH-PIR-OCUPANCY-BATT</td>
<td>PIR Occupancy Sensor (AUTO-ON, AUTO-OFF)</td>
</tr>
</tbody>
</table>
Private Restroom

Steinel

- Local control (9.4.1.1.a) is optional.
- Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

### ASHRAE 90.1-2016

#### Code Compliance:

- Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- Local Control (9.4.1.1.a)
- Automatic Full Off (9.4.1.1.h)

### Local Control:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Qty.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>GLA-IR-VS-1</td>
<td>STEINEL IR VS 1 Passive Infrared Wall Switch Vacancy Sensor, White</td>
</tr>
</tbody>
</table>
Public Restroom

Zūm

ASHRAE 90.1-2016 Code Compliance:

- Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- Local Control (9.4.1.1.a)
- Automatic Full Off (9.4.1.1.h)

Local Control:

- Local control (9.4.1.1.a) is optional.
- Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Qty.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>ZUMMESH-JBOX-5A-LV</td>
<td>Zūm™ Junction Box Zone Controller, 0-10V Dimming, 5A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>ZUMMESH-JBOX-SIM</td>
<td>Zūm™ Junction Box Sensor Integration Module</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>ZUMMESH-NETBRIDGE</td>
<td>Zūm™ Network Bridge</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>ZUMMESH-KP10ABATT</td>
<td>Rocker-Button Battery Powered Keypad</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>GLS-ODT-C-NS</td>
<td>Dual-Technology Ceiling Mount Occupancy Sensor</td>
</tr>
</tbody>
</table>
## Public Restroom

### GLPP

![Diagram of GLPP setup]

**ASHRAE 90.1-2016 Code Compliance:**

- Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- Local Control (9.4.11.a)
- Automatic Full Off (9.4.11.h)

### Local Control:

- Local control (9.4.11.a) is optional.
- Automatic daylight control (photocontrol) (9.4.11.e/f) may be required if windows are present.

### Product List

<table>
<thead>
<tr>
<th>Product</th>
<th>Qty.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="GLPP-1DIMFLV2CN-PM" /></td>
<td>1</td>
<td>2-Ch 0-10V Dimmer with Cresnet® Control</td>
</tr>
<tr>
<td><img src="image" alt="GLPPA-KP" /></td>
<td>1</td>
<td>In-Wall Keypad for GLPP</td>
</tr>
<tr>
<td><img src="image" alt="GLS-ODT-C-NS" /></td>
<td>2</td>
<td>Dual-Technology Ceiling Mount Occupancy Sensor</td>
</tr>
</tbody>
</table>