



sixteen5hundred

Title 24 2019 Updates

■ The One Stop Shop For All Of Your Lighting and Lighting Controls Solutions

OVERVIEW

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Introductions – History of 16500/Title 24



Updates and changes to Title 24
Lighting and Controls

Indoor Lighting and Non-residential Controls
Changes

Outdoor Lighting and Controls Changes



16500 Title 24 reference guide deep dive



Application Exercises/ Breakout session



Questions

History of:

- ✓ Founded in 1998
- ✓ Company name originated from "older" CSI template. 16500 was the lighting specifications section
- ✓ Currently represent over 90 of the industry's top manufacturers
- ✓ Employ more than 75 professionals with a wide range of unique and specialized talents and skill sets, building a reputation for expertise and knowledge of industry innovation and high level customer service

sixteen⁵hundred

16500 supports your LIGHTING and LIGHTING CONTROLS needs:

Lighting Control Applications Engineering and Design:

- ✓ Product/system selection
- ✓ Wiring diagrams
- ✓ CAD Assistance
- ✓ System Layouts
- ✓ Quotations
- ✓ Submittals
- ✓ Fixture-integrated controls coordination
- ✓ CALCTP-AT Certified Employer, Field Services, Programming/Product Technical Support

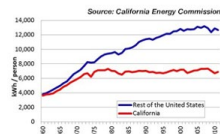
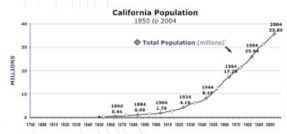
Lighting Applications Engineering and Design:

- ✓ Product selection and technical support
- ✓ Product specific lighting illuminance & power density calculations
- ✓ Lighting layouts
- ✓ Fixture schedule crossovers/ VE alternates
- ✓ Quotations
- ✓ Submittals



History of Title 24:

- ✓ Enacted in 1976 under *Warren-Alquist Act in the response to the 1970's energy crisis*
- ✓ Part of the CALIFORNIA CODE OF REGULATIONS- Title 24 and operated by the California Energy Commissions. (CEC)
- ✓ "Title 24" is really part six of the REGULATIONS and called the BUILDING ENERGY EFFICIENCY STANDARDS (Cal Green is Part 11)
- ✓ Updates released every three years. January 1, 2020 is next. CEC is currently seeking public input for the 2022 standards
- ✓ California's population has doubled since 1976 but energy consumption remained flat.



690 Folsom Street, SF



Pleasanton Fire House Arts Center



16500 IN-HOUSE DESIGN SERVICES



Plumas/Sierra Counties Courthouse



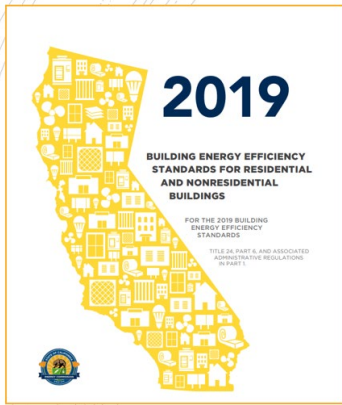
UC Hastings School of Law Tower



690 Folsom Street, SF



***Title 24 2019 UPDATES**
and **CHANGES** to the 2016 Code*



EFFECTIVE DATE

■ Title 24, Part 6, 2019 Standards become effective for projects submitted for PLAN CHECK on or after January 1, 2020

■ 2019 code available on www.energy.ca.gov/title24/2019standards/





Table 32.2 | Office Facilities Illuminance Recommendations continued from previous page

Applications and Tasks ^a	Notes	Recommended Maintained Illuminance Targets (lux) ^{b,c,d}									
		Horizontal (E _h) Targets					Vertical (E _v) Targets				
		Visual Ages of Observers (years) where at least half are					Visual Ages of Observers (years) where at least half are				
		<25	25-65	>65			<25	25-65	>65		
		Category ▼				Gauge ▼	Category ▼				Gauge ▼
READING AND WRITING	(continued)										
• Xerograph	Copier- and printer-generated on white paper										
• ≥8-pt type, common graphics	Select progressively next-higher letter category of illuminance for each 2-point-type decrease in fonts/graphics)										
• Color											
• Analog	E _h @2' 6" AFF; E _v @4' AFF ^f	R	250	500	1000	Avg	M	50	100	200	Avg
• Digital	E _h @2' 6" AFF; E _v @4' AFF ^f	P	150	300	600	Avg	L	37.5	75	150	Avg
• Grayscale and/or B+W Print											
• Analog	E _h @2' 6" AFF; E _v @4' AFF ^f	P	150	300	600	Avg	L	37.5	75	150	Avg
• Digital	E _h @2' 6" AFF; E _v @4' AFF ^f	O	100	200	400	Avg	K	25	50	100	Avg
SUPPORT SPACES											
• Break Rooms/Lunch Rooms	E _h @2' 6" AFF; E _v @4' AFF	M	50	100	200	Avg	I	15	30	60	Avg
• Coat Check or Coat Rooms	E _h @3' 0"; E _v @5' AFF	P	150	300	600	Avg	M	50	100	200	Avg
• Copy/Print Rooms											
• General	E _h @floor; E _v @5' AFF	M	50	100	200	Avg	I	15	30	60	Avg
• Machines	E _h and E _v @3' 6" AFF	P	150	300	600	Avg	M	50	100	200	Avg
• Janitor's Closet	E _h @floor; E _v @4' AFF	M	50	100	200	Avg	I	15	30	60	Avg
• Mail Facility											
• General	E _h @floor; E _v @5' AFF	M	50	100	200	Avg	J	20	40	80	Avg
• Security Inspection	E _h and E _v @3' 6" AFF	T	500	1000	2000	Avg	P	150	300	600	Avg
• Sorting	E _h @2' 6" AFF; E _v @4' AFF	P	150	300	600	Avg	L	37.5	75	150	Avg
• Receiving/Shipping											
• Dock	E _h @floor; E _v @4' AFF	M	50	100	200	Avg	I	15	30	60	Avg
• Receiving/Staging	E _h @floor; E _v @4' AFF	P	150	300	600	Avg	M	50	100	200	Avg
• Storage											
• Food	See 22 LIGHTING FOR COMMON APPLICATIONS/Food Service										
• Frequent Use	E _h @floor; E _v @4' AFF	M	50	100	200	Avg	I	15	30	60	Avg
• Infrequent Use	E _h @floor; E _v @4' AFF	K	25	50	100	Avg	H	10	20	40	Avg
TOILETS/ LOCKER ROOMS	See 22 LIGHTING FOR COMMON APPLICATIONS										
TRAINING ROOMS	See 24 LIGHTING FOR EDUCATION/CLASSROOMS										
TRANSITION SPACES											
• Circulation Corridors	As the architect coordinates contrast markings with steps, curbs, and ramps, localized lighting may be deemed appropriate.										
• Adjacency Passageways	E _h @floor; E _v @5' AFF	Avg ≥0.3 times task E _h of adjacent space or as cameras require, but with min ≥10 lx					Avg ≥0.3 times task E _v of adjacent space or as cameras require				
• Breakout Passageways	E _h @floor; E _v @4' AFF	M	50	100	200	Avg	I	15	30	60	Avg
• Independent Passageways	E _h @floor; E _v @5' AFF	K	25	50	100	Avg	I	15	30	60	Avg
• Elevators											
• Freight											
• Cab Interior	E _h @floor; E _v @3' AFF	K	25	50	100	Avg	I	15	30	60	Avg
• Threshold											
• Cab exterior	E _h @floor; E _v @5' AFF	K	25	50	100	Avg	I	15	30	60	Avg
• Cab Interior	E _h @floor; E _v @5' AFF	K	25	50	100	Avg	I	15	30	60	Avg

Table 32.2 | Office Facilities Illuminance Recommendations continued next page

TABLE 140.6-B COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES

TYPE OF BUILDING	ALLOWED LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)
Assembly Building	0.70
Financial Institution Building	0.65
Industrial/Manufacturing Facility Building	0.60
Grocery Store Building	0.95
Gymnasium Building	0.65
Library Building	0.70
Healthcare Facility	0.90
Office Building	0.65
Parking Garage Building	0.13
Religious Facility Building	0.70
Restaurant Building	0.70
Retail Store Building	0.90
School Building	0.65
Sports Arena Building	0.75
Motion Picture Theater Building	0.70
Performing Arts Theater Building	0.80
All others buildings	0.40

TABLE 140.6-C AREA CATEGORY METHOD - LIGHTING POWER DENSITY VALUES (WATTS/FT²)

Primary Function Area		Allowed Lighting Power Density for General Lighting (W/ft ²)	Additional Lighting Power ¹	
			Qualified Lighting Systems	Additional Allowance (W/ft ² , unless noted otherwise)
Auditorium Area		0.70	Ornamental	0.30
			Accent, display and feature ³	0.20
Auto Repair / Maintenance Area		0.55	Detailed Task Work ⁷	0.20
Audience Seating Area		0.60	Ornamental	0.30
Beauty Salon Area		0.80	Detailed Task Work ⁷	0.20
			Ornamental	0.30
Civic Meeting Place Area		1.00	Ornamental	0.30
Classroom, Lecture, Training, Vocational Area		0.70	White or Chalk Board ¹	4.50 W/ft
Commercial/Industrial Storage	Warehouse	0.45	-	-
	Shipping & Handling	0.60	-	-
Convention, Conference, Multipurpose and Meeting Area		0.85	Ornamental	0.30
Copy Room		0.50	-	-
Corridor Area		0.60	-	-
Dining Area	Bar/Lounge and Fine Dining	0.55	Ornamental	0.30
	Cafeteria/Fast Food	0.40		
	Family and Leisure	0.50		
Electrical, Mechanical, Telephone Rooms		0.40	Detailed Task Work ⁷	0.20
Exercise/Fitness Center and Gymnasium Area		0.50	-	-
Hotel Function Area		0.85	Ornamental	0.30



INDOOR LIGHTING AND NON-
RESIDENTIAL ***CONTROLS***
CHANGES

Biggest **INTERIOR** lighting changes in 2019: Power allowances reduced
(on average over 35%)

Primary Function Area			Allowed Lighting Power Density for General Lighting (W/ft ²)
Auditorium Area	2016	1.2 w/sf	0.70
	2019	0.75 w/sf	0.65
Office Area	>250	0.75 w/sf	0.65
	<250	1.00 w/sf	0.70
This is new			Open plan office
			0.60



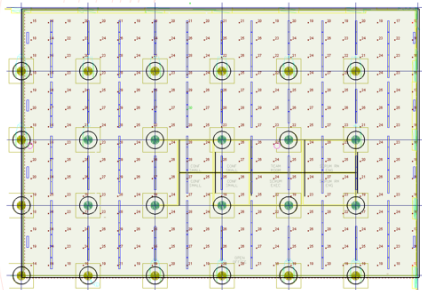
INTERIOR LIGHTING

SAMPLE PROJECT: SOMA OFFICES, SF

20' CIELINGS/ GREY CONCRETE COLUMNS

IES = 30 FC

2019 TITLE 24 = 0.60 W/SF



OPEN OFFICE

Average	24	fc
Maximum	30	fc
Minimum	13	fc
Max/Min	2.3:1	
Average/Min	1.8:1	

Power Density

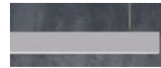
Luminaires	188
Total Power	9024.00 W
Area	12512.34 ft ²
Power Density	0.72 W/ft ²
Perimeter	456.20 ft

24 FC AVG FOR OPEN OFFICES

DOES NOT MEET IES

0.72 WATTS / SF

DOES NOT MEET
TITLE 24 CODE



INTERIOR LIGHTING: SOMA

Statistics

Description	Avg	Max	Min	Max/Min	Avg/Min	Avg/Max
OPEN OFFICE	32 fc	45 fc	19 fc	2.4:1	1.7:1	0.7:1

Power Statistics

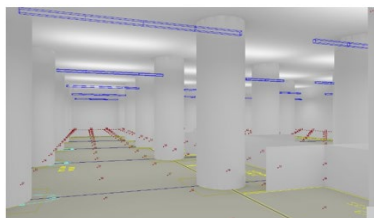
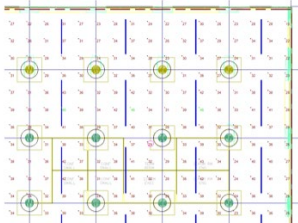
Description	# Luminaires	Total Watts	Area	Density
Power Density	90	4852.80 W	12755.17 ft ²	0.38 W/ft ²

Slot 4 PSW LED
S4LD Pendant, Surface and Wall
by Mark Anderson Lighting



122 LUMENS/WATT (LPW)

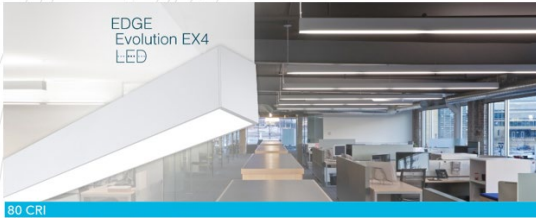
IES 30 FC / 4:1 UNIFORMITY RATIO
2019 TITLE 24 0.60 W/SF



INTERIOR LIGHTING

THINK: “HIGH LUMENS PER WATT” (LPW) FIXTURES WHEN SPECIFYING PRODUCT

PINNACLE EDGE EVOLUTION SERIES: 111 TO 131 LPW



LUMIUM CARBON 2 SERIES: 98 LPW



LUMIUM TITANIUM SERIES: 98 LPW
(100lm)

	Color	Lumens per foot	Shielding ¹		AL Drop LPW	HE High Efficiency LPW	BW Battling LPW	WHE Asymmetric LPW	HED Descant LPW			
			A LPW	Watts/ft						LPW	Watts/ft	LPW
830	3000K	500	111	4.5	101	4.9	123	4.1	124	4.0	111	4.5
830HO	3000K	750	112	6.7	102	7.3	127	5.9	125	6.0	113	6.6
830VHO	3000K	1000	111	11.8	103	9.7	127	7.9	125	8.0	113	8.9
835	3500K	500	114	4.4	105	4.8	127	4.0	125	4.0	115	4.4
835HO	3500K	750	115	6.5	105	7.1	129	5.8	127	5.9	117	6.4
835VHO	3500K	1000	115	8.7	107	9.3	131	7.6	129	7.7	116	8.6
840	4000K	500	114	4.4	105	4.8	127	4.0	125	4.0	115	4.4
840HO	4000K	750	115	6.5	105	7.1	129	5.8	127	5.9	117	6.4
840VHO	4000K	1000	115	8.7	107	9.3	131	7.6	129	7.7	116	8.6

LITHONIA IBG SERIES: 146 LPW
HL-CEILING WAREHOUSES



PEERLESS OPEN SERIES: 106 LPW

INDOOR - CONTROLS

RESTROOMS

Exception 1:

Occupancy sensors **REQUIRED** for auto shut-off **Section 130.1(c)**

Exception 2:

Exempted from multi-level controls – **Section 130.1(b)**



INDOOR - CONTROLS

AUTOMATIC DEMAND RESPONSE– Section 110.12

➤ Moved from **Section 130.1(e)** to **Section 110.12**



➤ Consolidated ADR requirements for HVAC, Lighting Controls, Electronic Message Center

➤ ADR to be either certified **OpenADR 2.0a** or **OpenADR 2.0b Virtual End Node (VEN)**.

➤ Demand response controls shall be communicating by: **Wi-Fi, Zigbee, BACnet, Ethernet or hard-wiring.**



BECY							Example: BECY MV01T BAC ENC	
Series	Voltage	BACnet	AutoDR	Visualization Software	On-time Energy Metering	Enclosure	Touchscreen Kit	
BECY Night BCLPSE	24 24 VACDC MV01T 120/277 VAC	[blank] Not Enabled BAC BACnetIP & MCTP Enabled	[blank] Not Enabled ADR OpenADR VEN	[blank] Not Enabled SVC Emulation	[blank] Not Enabled SVC Emulation	[blank] No enclosure NEMA Type 1 metal enclosure	[blank] No touchscreen GFX Touchscreen interface module mGFX12 GFL mounted PS 150 power supply CMTS cable	

INDOOR - CONTROLS

NEW EXCEPTIONS TO DAYLIGHTING - Section 130.1(d)

EXCEPTION 1:

Areas under skylight where existing adjacent structure or outdoor object block direct sunlight for more than 1,500 daytime hours per year between 8AM to 4PM (~4 hours per day)




Exception 2:

Areas adjacent to vertical glazing below an **overhang**, where the overhang covers the entire width of the vertical glazing, no vertical glazing is above the overhang, and the ratio of the overhang projection to overhang rise is greater than 1.5 for South, East and West orientations or greater than 1 for North orientations.



Exception 3:

Luminaires in the sidelit daylight zones in **retail merchandise sales and wholesale showroom sales.**



✓

INDOOR - CONTROLS

CONTROL INTERACTIONS – Section 130.1(f)

➤ For general lighting, the manual control shall permit the level or amount of light provided while the lighting is ON to be set or adjusted by the controls specified in Section 130.b, c, d, and e.

➤ *The manual area control shall permit the shutoff control to turn the lighting down or OFF.*

➤ *The multi-level lighting control shall permit the automatic daylighting control to adjust the electric lighting level in response to changes in the amount of daylight in the daylight zone.*

➤ The multi-level lighting control shall permit the demand responsive control to adjust the lighting during a demand response event and to return it to the level set by the multilevel control after the event.

➤ The shutoff control shall permit the manual area control to turn the lighting ON. If the ON request occurs while an automatic time switch control would turn the lighting OFF, the ON request shall be treated as an override request consistent with Section 130.1(c)3

➤ *The automatic daylighting control shall permit the multi-level lighting control to adjust the level of lighting.*

➤ For the lighting controlled by multi-level lighting controls and by occupant sensing controls that provide an automatic ON function, the controls shall provide a partial ON function that is capable of automatically activating between 50-70% of controlled lighting power.

✓

ALTERATIONS - CONTROLS

▪ Applies to 10% or more luminaires in an enclosed space
▪ Control requirements will be determined by one of the 3 lighting paths chosen:

LIGHTING PATH 1 Section 141.0(b)2Ii:

➤ Meets lighting power allowance in Section 140.6

LIGHTING PATH 2 Section 141.0(b)2Iii:

➤ Reduce lighting power allowance in Section 140.6 by 20%

LIGHTING PATH 3 Section 141.0(b)2Iiii:

➤ Applies to small building or tenant spaces (5,000 sqft or less)
➤ Total wattage of altered luminaires versus pre-alteration wattage are at least 40% lower

✓

ALTERATIONS - CONTROLS

PATH 1

PATH 2 & 3

Table 141.6-F Control Requirements for Indoor Lighting System Alterations

Control Specification	Projects complying with Section 141.6(b)(2)(B)	Projects complying with Section 141.6(b)(2)(B) and 141.6(b)(2)(D)
Manual Area Controls		
130.11(a)	Required	Required
130.11(a)(2)	Required	Required
130.11(a)(3)	Only required for new or completely replaced controls	Only required for new or completely replaced controls
Multi-Level Controls		
130.11(b)	Required	Not Required
Automatic Shut Off Controls		
130.11(c)	Required; 130.11(c)(1) only required for new or completely replaced controls	Required; 130.11(c)(1) only required for new or completely replaced controls
130.11(c)(2)	Required	Required
130.11(c)(3)	Required	Required
130.11(c)(4)	Required	Required
130.11(c)(5)	Required	Required
130.11(c)(6)	Required	Required
130.11(c)(7)	Required	Required
130.11(c)(8)	Required	Required
Overlighting Controls		
130.11(d)	Required	Not Required
Demand Responsive Controls		
130.11(e)	Required	Not Required

Excerpt from Title 24 2019

Control Specification	Type	Projects complying with Section 141.6(b)(2)(B)	Projects complying with Section 141.6(b)(2)(B) and 141.6(b)(2)(D)
Manual Area Controls			
130.11(a)	Required	Required	Required
130.11(a)(2)	Required	Required	Required
130.11(a)(3)	Only required for new or completely replaced controls	Only required for new or completely replaced controls	Only required for new or completely replaced controls
Multi-Level Controls			
130.11(b)	Required	Required	Not Required
Automatic Shut Off Controls			
130.11(c)	Required	Required	Required
130.11(c)(2)	Required	Required	Required
130.11(c)(3)	Required	Required	Required
130.11(c)(4)	Required	Required	Required
130.11(c)(5)	Required	Required	Required
130.11(c)(6)	Required	Required	Required
130.11(c)(7)	Required	Required	Required
130.11(c)(8)	Required	Required	Required
Overlighting Controls			
130.11(d)	Required	Not Required	Not Required
Demand Responsive Controls			
130.11(e)	Required	Not Required	Not Required

Excerpt from UC Davis

ALTERATIONS - CONTROLS

EXCEPTIONS:

***EXCEPTION 1: Alterations with less than 10% luminaires on enclosed space**

EXCEPTION 2: Alteration of portable luminaires, luminaires affixed to moveable partitions or lighting excluded per Section 140.6(a)3

***EXCEPTION 3: Any enclosed space with 1 luminaire**

EXCEPTION 4: Any alteration that would cause the disturbance of asbestos, unless it is made in conjunction with asbestos abatement

EXCEPTION 5: Acceptance testing requirements are not required for alteration where lighting controls are added to control 20 luminaires or less

***EXCEPTION 6: Any alteration limited to adding lighting controls or replacing lamps, ballasts or drivers**

***EXCEPTION 7: One for one luminaire alteration of up to 50 luminaires either per complete floor of the building or per complete tenant space, per annum**



OUTDOOR LIGHTING AND
CONTROLS CHANGES

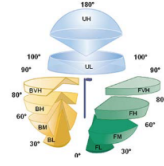
OUTDOOR - LIGHTING

2019 POWER ALLOWANCES REDUCED (up to 50%)

TABLE 140.7-A GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE

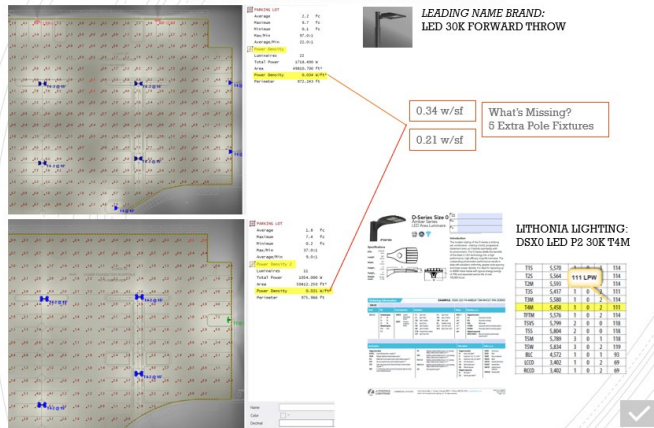
Type of Power Allowance	Lighting Zone 0 ¹ Asphalt/Concrete	Lighting Zone 1 ¹ Asphalt/Concrete	Lighting Zone 2 ¹ Asphalt	Concrete ²	Lighting Zone 3 ² Asphalt	Concrete ²	Lighting Zone 4 ² Asphalt/Concrete
Area Wattage Allowance (AWA)	No allowance ¹	0.018 W/ft ²	0.023 W/ft ²	0.025 W/ft ²	2016 0.040 wsf 0.025 W/ft ²	0.03 W/ft ²	0.03 W/ft ²
Linear Wattage Allowance (LWA)		0.15 W/lf	0.17 W/lf	0.4 W/lf	2016 0.035 LF 0.25 W/lf	0.4 W/lf	0.35 W/lf
Initial Wattage Allowance (IWA)		180 W	250 W	250 W	2016 350 watts 350 W	350 W	400 W

PLUS OUTDOOR BUG RATINGS HAVE CHANGED



OUTDOOR - LIGHTING

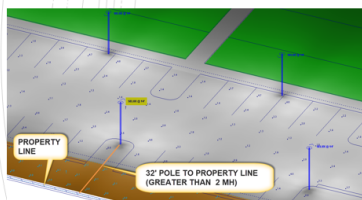
PARKING LOT LIGHTING LAYOUT IN 2019 CODE



OUTDOOR - LIGHTING

BACKLIGHT/UPLIGHT/GLARE (BUG)

ALLOWABLE RATING	LIGHTING ZONE 1	LIGHTING ZONE 2	LIGHTING ZONE 3	LIGHTING ZONE 4
Maximum Allowable Backlight Rating¹				
Luminaire greater than 2 mounting heights (MH) from property line	No Limit	No Limit	No Limit	No Limit
Luminaire back hemisphere is 1 – 2 MH from property line	B2	B3	B4	B4
Luminaire back hemisphere is 0.5 – 1 MH from property line	B1	B2	B3	B3
Luminaire back hemisphere is less than 0.5 MH from property line	B0	B0	B1	B2
Maximum Allowable Uplight Rating				
For area lighting ¹	U0	U0	U0	U0
For all other outdoor lighting, including decorative luminaires	U1	U2	U3	U4
Maximum Allowable Glare Rating¹				
Luminaire greater than 2 MH from property line	G1	G2	G3	G4
Luminaire from hemisphere is 1 – 2 MH from property line	G0	G1	G2	G2
Luminaire from hemisphere is 0.5 – 1 MH from property line	G0	G0	G1	G1
Luminaire back hemisphere is less than 0.5 MH from property line	G0	G0	G0	G1



Average	0.1 fc	2019 BUG RATINGS
Maximum	0.2 fc	TRIGGER
Minimum	0.0 fc	>6200 LUMENS
Max/Min	N/A	(2016>150watts)
Average/Min	N/A	
Average	2.0 fc	
Maximum	4.8 fc	
Minimum	0.4 fc	
Max/Min	12.0:1	
Average/Min	5.0:1	

selux



OUTDOOR - LIGHTING

THE NUMBERS BEHIND THE **BUG** RATING

Addendum A for IESNA TM-15-07: Backlight, Uplight, and Glare (BUG) Ratings

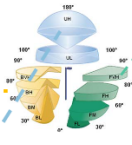
The following Backlight, Uplight, and Glare ratings may be used to evaluate luminaire optical performance related to light trespass, sky glow, and high angle brightness control. These ratings are based on a zonal lumen calculations for secondary solid angles defined in TIA-15.47. The zonal lumen breakdowns listed in the following three tables are based on data from photometric testing procedures approved by the Illuminating Engineering Society for outdoor luminaires (LM-31 or LM-35).

Table A-1: Backlight Ratings (maximum zonal lumens)

Secondary Solid Angle	Backlight Rating					
	B0	B1	B2	B3	B4	B5
BH	110	500	1000	2500	5000	>5000
FWH	220	1000	2500	5000	8500	>8500
UL	110	500	1000	2500	5000	>5000

Table A-2: Uplight Ratings (maximum zonal lumens)

Secondary Solid Angle	Uplight Rating					
	U0	U1	U2	U3	U4	U5
UL	0	10	100	500	1000	>1000
FWH	0	10	100	500	1000	>1000
BH	10	75	150	>150		
BH	10	75	150	>150		



ZONAL LUMENS

REMEMBER:

**<6200 LUMENS
BUG
REQUIREMENTS
DON'T APPLY**

Table A-3: Glare Ratings (maximum zonal lumens)

Secondary Solid Angle	Glare Rating for Asymmetrical Luminaire Types (Type I, Type II, Type III)					
	G0	G1	G2	G3	G4	G5
FWH	10	250	375	500	750	>750
BH	10	250	375	500	750	>750
FWH	600	1000	5000	7500	12000	>12000
BH	110	500	1000	2500	5000	>5000

Table A-4: Glare Rating for Quadrilateral Symmetrical Luminaire Types (Type V, Type V Square)

Secondary Solid Angle	Glare Rating for Quadrilateral Symmetrical Luminaire Types (Type V, Type V Square)					
	G0	G1	G2	G3	G4	G5
FWH	10	250	375	500	750	>750
BH	10	250	375	500	750	>750
FWH	600	1000	5000	7500	12000	>12000
BH	600	1000	5000	7500	12000	>12000

OUTDOOR - CONTROLS

DAYLIGHT ABILITY - Section 130.2(c)1

- Outdoor lighting controlled by photocell or astronomical time clock

AUTOMATIC SCHEDULING - Section 130.2(c)2

- All lighting must be controlled to allow **at least 50% of lighting to be turn OFF at night (but no more than 90%)**
- And **allow minimum of two night-time periods with independent lighting levels.** May include override function that turns ON during its scheduled dim or OFF state for no more than 2-hours when an override is initiated.



OUTDOOR - CONTROLS

MOTION SENSORS – SECTION 130.2 (c) 3

- Required for all outdoor luminaires **at or below 24 feet with more than 40 Watts**
- EXCEPTIONS
 - **Fixtures 40 Watts or less**
 - **Mounting height over 24 feet**
- Motion sensor on each fixture** is capable of reducing outdoor lighting power by **at least 50% but no more than 90%** and separately turn OFF during unoccupied period (HIGH-LOW-OFF)
- Maximum time delay is 15 min.
- Single sensor cannot control more than 1,500 watts of lighting.



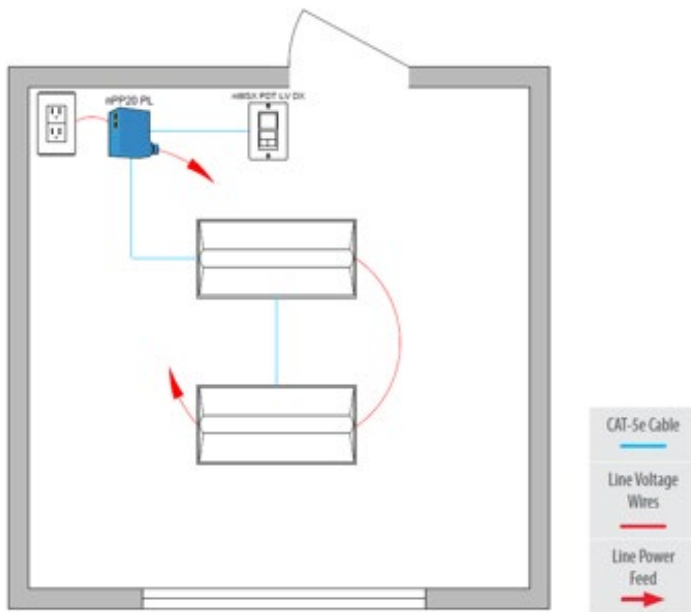


APPLICATIONS EXERCISES

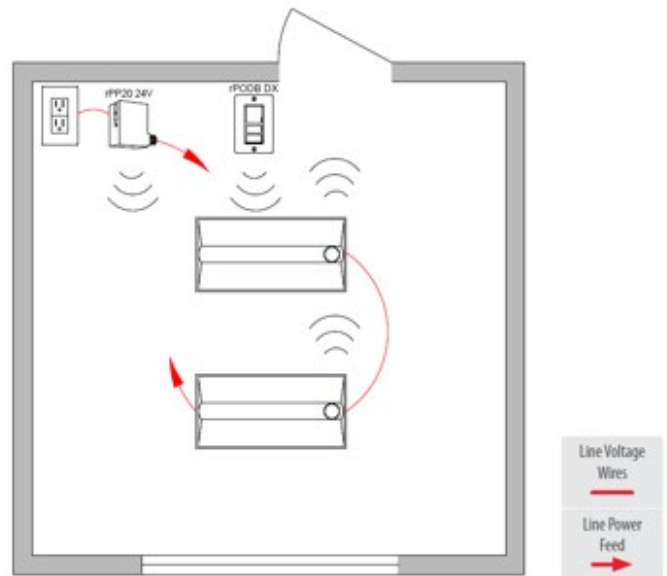
APPLICATIONS EXERCISE #1

Office: < 250sq. Ft., Windows, nLight Enabled Fixtures

Wired



Wireless



/ OPERATION DETAILS:

Light Fixtures:

- All fixtures are dimmable
- All fixtures can be controlled together or independently
- Maximum level can be task tuned to any percentage via programming

Occupancy Control:

- Partial-on occupancy sensors automatically activate between 50-70% of controlled lighting power or fixtures must be turned on manually
- Plug load turns on automatically
- Fixtures and plug load automatically turn off when room becomes vacant

Daylight Control:

- Not required if room has < 24 ft² of glazing or lighting load < 120W in the skylit and the sidelit daylight zone

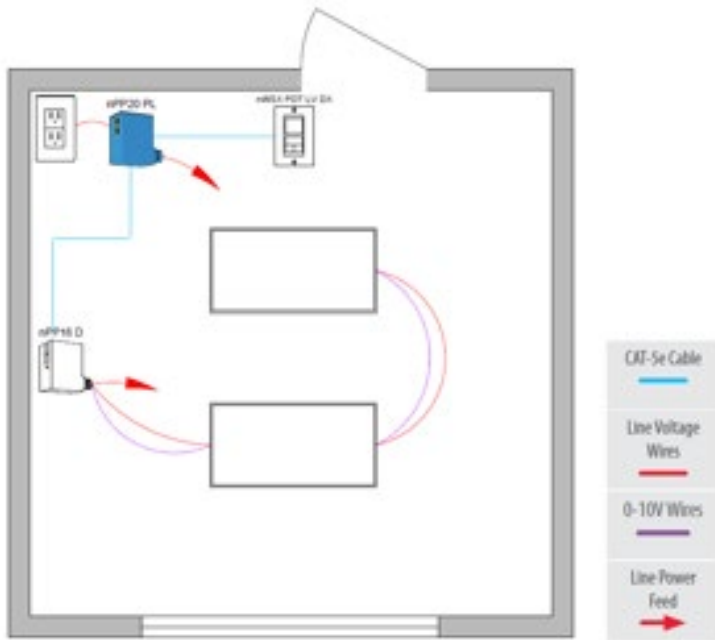
Manual Control:

- On/off & raise/lower control of fixtures

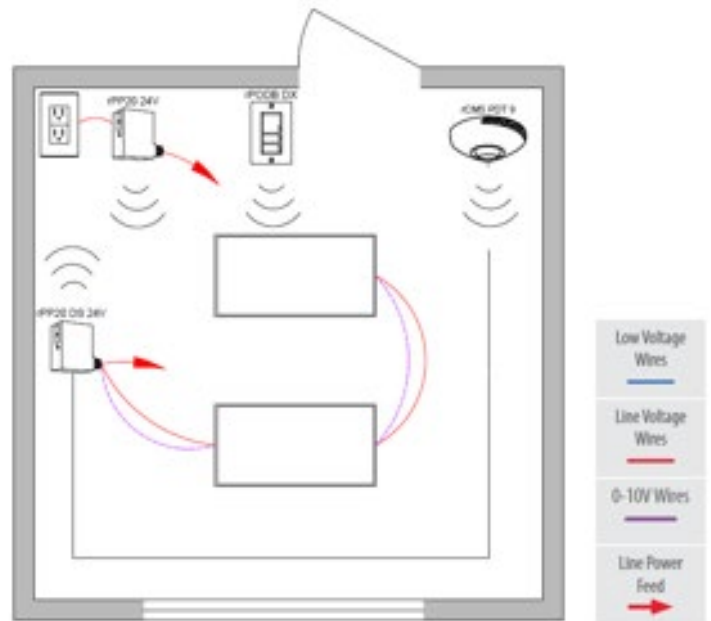
APPLICATIONS EXERCISE #2

Office: < 250sq. Ft., Windows, 0-10V Dimming Fixtures

Wired



Wireless



/ OPERATION DETAILS:

Light Fixtures:

- All fixtures are dimmable
- Fixtures are controlled based on power pack line voltage and 0-10V wiring
- Maximum level can be task tuned to any percentage via programming

Occupancy Control:

- Partial-on occupancy sensors automatically activate between 50-70% of controlled lighting power or fixtures must be turned on manually
- Plug load turns on automatically
- Fixtures and plug load automatically turn off when room becomes vacant

Daylight Control:

- Not required if room has < 24 ft² of glazing or lighting load < 120W in the skylit and the sidelit daylight zone

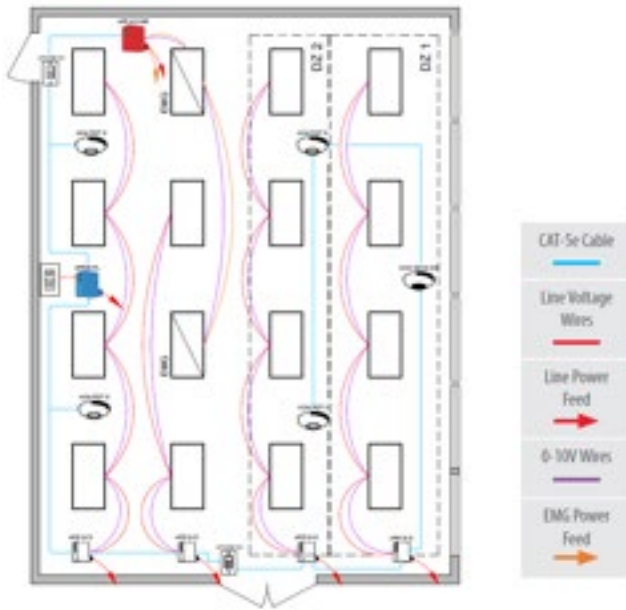
Manual Control:

- On/off & raise/lower control of fixtures

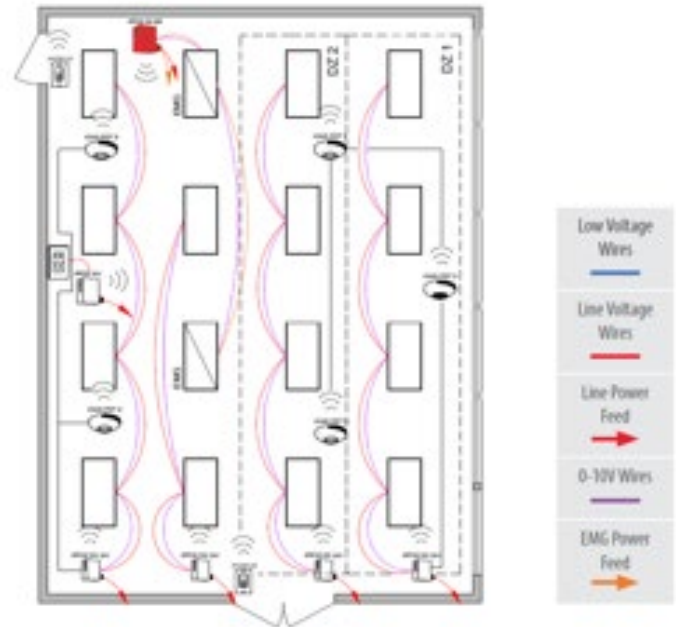
APPLICATIONS EXERCISE #3

Open Office with 0-10V Dimming Fixtures

Wired



Wireless



/ OPERATION DETAILS:

Light Fixtures:

- All fixtures are dimmable
- Fixtures are controlled based on power pack line voltage and 0-10V wiring
- Maximum level can be task tuned to any percentage via programming

Occupancy Control:

- Partial-on occupancy sensors automatically activate between 50-70% of controlled lighting power or fixtures must be turned on manually
- Plug load turns on automatically
- Fixtures and plug load automatically turn off when room becomes vacant

Daylight Control:

- Not required if room has < 24 ft² of glazing or lighting load < 120W in the skylit and the sidelit daylight zone
- Smooth continuous dimming
- Daylight zones defined by relay packs

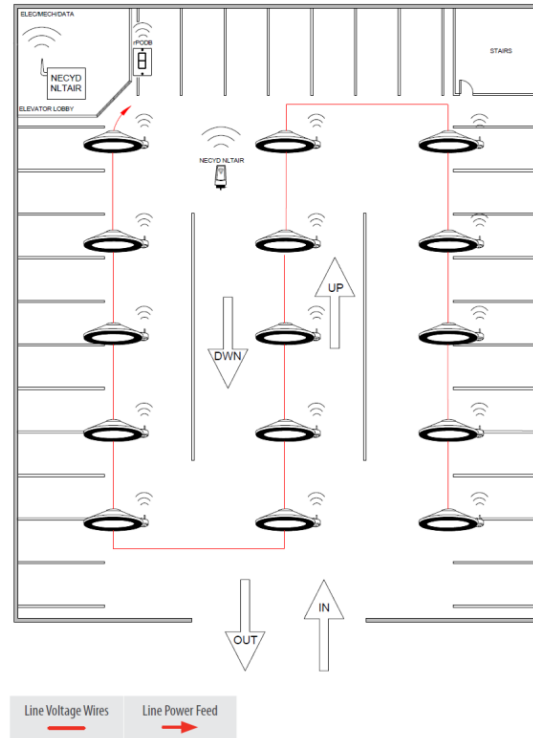
Manual Control:

- On/off & raise/lower control of fixtures

APPLICATIONS EXERCISE #5

Parking Garage with nLight AIR Enabled Fixtures

Wireless Parking Garage



/ OPERATION DETAILS:

Light Fixtures:

- All fixtures are dimmable
- All fixtures can be controlled together or independently
- Maximum level can be task tuned to any percentage via programming

Occupancy Control:

- Fixtures automatically turn off or optionally can be configured to drop to low dim setting of 20-50% when space becomes vacant

Daylight Control:

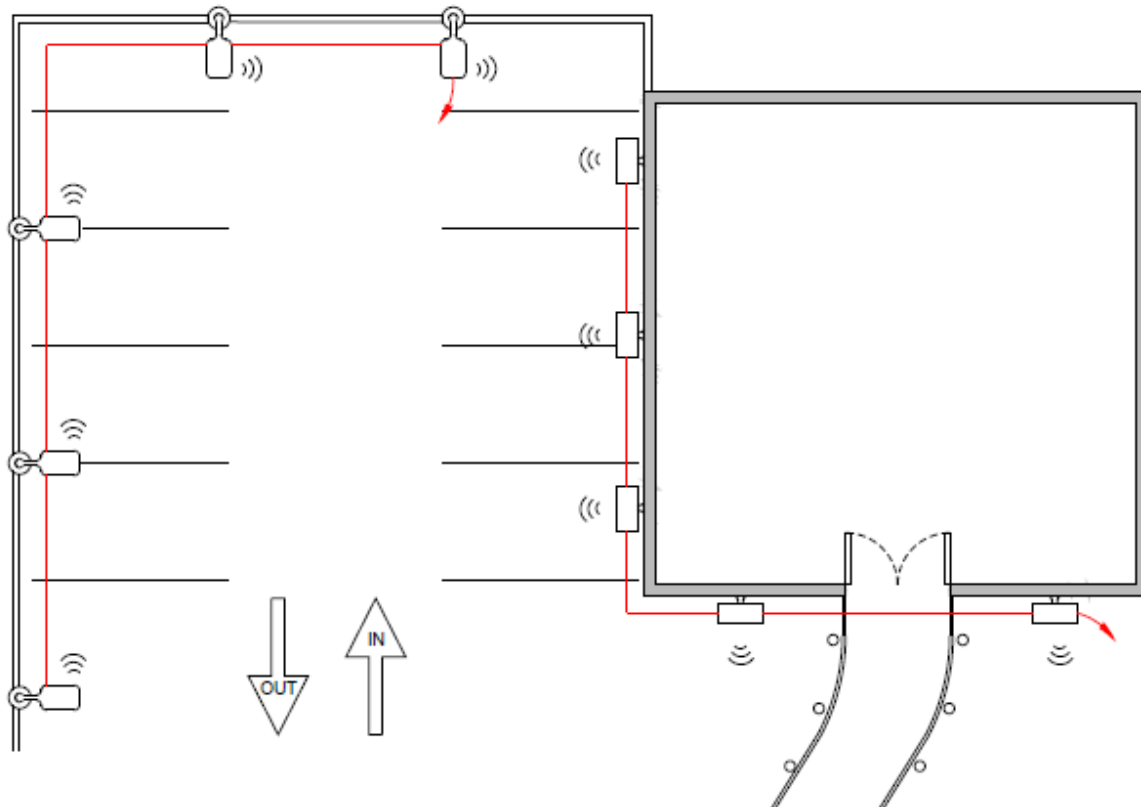
- Not required if room has < 36 ft² of glazing or lighting load < 60W in the sidelit daylight zone
- Smooth continuous dimming
- Custom grouping of fixtures into separate daylight zones (max. number of zones = number of fixtures)

Manual Control:

- On/off control of fixtures

APPLICATIONS EXERCISE #6

Site Lighting with nLight AIR Enabled Fixtures



/ OPERATION DETAILS:

Light Fixtures:

- All fixtures are dimmable
- All fixtures can be controlled together or independently
- Maximum level can be task tuned to any percentage via programming

Occupancy Control:

- Fixtures automatically go to full bright when occupied
- Fixtures automatically turn off or optionally can be configured to reduce power by at least 50-90% when space becomes unoccupied

Daylight Control:

- Daylight responsive controls lights to full off when adequate daylight present



sixteen**5**hundred

THANK YOU!!!!