

Wentz Concert Hall and Fine Arts Center

North Central College
Naperville, Illinois



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AE 472 / 897G - Final Report

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Executive Summary

The Wentz Concert Hall and Fine Arts Center is an exhibitional and educational facility constructed at North Central College in 2008. Located in Naperville, Illinois, the building is approximately 30 miles west of Chicago. It was designed to meet the needs of the college's educational programs, as well as to promote the arts in the wider Naperville community. This report will examine several aspects of the building and propose alternative design options.

The main focus of this study is a lighting and power redesign of four parts of the building: the main lobby, the concert hall, the music rehearsal room, and the façade. For the concert hall, it also includes studies of the space's architectural and acoustical aspects. For the lighting designs, an overarching theme is developed to help unify the spaces with each other and the overall architectural style. In the main lobby, I've performed a computer rendering using Radiance techniques learned in Flux Transfer Theory. The designs are performed with a focus on energy efficiency in what is traditionally an energy intensive building type.

Additionally, this report considers the alternative of a reduced number of transformers to serve its 120/208 V electrical loads, and the addition of a roof mounted solar array. A short circuit study of the electrical system is included, as is a protective device coordination study for a portion of the building.

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Project Background

The Wentz Concert Hall and Fine Arts Center is owned and operated by North Central College, in Naperville, Illinois. It is the college's second fine arts facility, the first being Pfeiffer Hall, with 1,050 seats. The Wentz, completed in 2008, seeks to provide a smaller concert hall, seating 605, with greatly improved acoustics.

In addition to the concert hall, the facility has Naperville's first art gallery, as well as a black box theater. It also includes music practice rooms, offices, a computer lab, and a large rehearsal space.

Existing Building Information

Project Summary

- Building Name: Wentz Concert Hall and Fine Arts Center
- Location: North Central College, Naperville Illinois
- Function: Concert hall, art gallery, education
- Size: 57,000 ft²
- Levels Above Grade: 2 (and catwalks)
- Total Levels : 3

Design Team

- Architect: Loebel Schlossman and Hackl
- Landscape Architect: Hitchcock Design Group
- Structural Engineer: Campbell and Associates
- MEP and Fire Protection: WMA Consulting Engineers
- Theater Planner: Schuler Shook
- Lighting Designer: Schuler Shook
- Acoustics and Audio Consultant: Talaske
- General Contractor: Gilbane
- Construction Manager: Gilbane

Lighting

Being a fine arts center, lighting systems are a critical aspect of the experience. The front of house areas, including the lobby, the art gallery, and the concert hall, are lit primarily by incandescent and halogen lighting. These provide a smooth spectrum of light, giving good and consistent color rendition through all of the spaces.

Restrooms, classrooms, offices, storage areas, the computer lab, and all of the other spaces that aren't likely to be a part of a visitor's experience to the fine arts center. In these spaces, lamp life and source efficacy outweigh the concerns in more public areas, and predominantly fluorescent lighting is used.

Fluorescent lamp types include 32W T8s, 31W U shaped T8s, 21W T5s, and 26W quad tube CFLs. A high pressure sodium lamp is used on the exterior at the loading dock.

Because of the nature of the facility, lighting controls are more complicated than what you'd see in a typical project. Two dimmer racks in the dimmer room are used by the concert hall lighting control system. Lighting in the public areas can be controlled by preset wall panels, with optional lockable covers. Smaller spaces, such as restrooms, offices, practice rooms, and storage, have occupancy sensors.

Electrical

The power distribution system is laid out radially, a single point of entrance branching out through a small network panels before reaching the branch circuits. The utility serves the building at 480Y/120 volts through a pad mounted transformer outside the electrical room. From the main switchboard in the electrical room, large equipment (primarily HVAC) is served directly at 480 volts. Smaller loads (lighting, receptacles, and AV) are served through five smaller transformers throughout the building. All lighting loads are operated at 120V; there are no lights directly on the 480/277V system.

While the bulk of the electrical equipment is in the main electrical room and its neighboring emergency electrical room, the dimmer room on the first floor holds three of the five 120/277V transformers, as well as the two dimmer racks and several branch panelboards. One of these transformers (T1-DCTP-1) is an isolation transformer, serves the clean technical power system. Clean technical power is used for audio processing racks, amplifier racks, the control booth, and orange CTP receptacles throughout the concert hall's back of house spaces. The CTP loads are connected to an isolated ground. An additional three dimmer racks serve the black box theater's lighting. The remainder of the panelboards are housed in small electrical closets.

Mechanical

The building has eight RTUs, six constant air volume and two variable air volume. The CAV units serve the concert hall, stage, black box theater, main lobby, and black box lobby. The VAV units serve the first floor and the lower level. Ventilation in the concert hall is provided through vaults under the floor, divided by CMU walls to direct airflow and reduce noise. The ductwork beneath the concert hall is plastic coated and buried in a concrete enclosure. As a result, the concert hall is almost completely silent.

Electric cabinet heaters are used in the vestibules by the main entrances. A number of spaces, particularly offices and theater support along the exterior walls, also include electric baseboard heaters.

Structural

The structural system is a combination of structural steel and precast concrete. The load bearing precast wall runs around the entire concert hall area, up through the lower roof level. The wall behind the stage continues to the upper roof level. A smaller number of walls, directly adjacent to the concert hall, are load bearing CMU.

There isn't an overall column and beam grid that extends through the whole building; instead, it reacts to the shapes of the spaces. This is especially in the concert hall, where beams wrap around the edge of

the balcony, and are cantilevered out from the lower columns. The office corridor's longest span is supported by a W18x75, while shorter spans are as small as W10x33.

Fire Protection

The fire protection system is supplied by water entering the plumbing room on the north end of the building. The plumbing room contains the fire pump, as well as the fire pump control center and transfer switch to allow it to run on emergency power from the generator. The vast majority of sprinklerheads are recessed to preserve the architecturally clean spaces. The exception to this is areas without appropriately finished ceilings, including the black box theater.

Transportation

There are two hydraulic elevators, one in the lobby for handicap access between the first floor and balcony level, and a second on the office corridor between the lower level and first floor. These floors are also accessible by stairs, with the main public stairs being between the lower black box theater lobby and main lobby, and at each end of the main lobby between the first floor and balcony level. There is also a stairway at each end of the office corridor, and back of house stairways into the balcony level reverb chambers, for access to the choral balcony. The catwalk level can be reached by a spiral staircase in the north reverb chamber.

Audiovisual

Most of the facility is wired to the audiovisual system, at least to some degree. The back of house rooms (office, etc) on the lower level have ceiling speakers, as do the art gallery, main lobby restrooms, lobby balcony corridor, and others. The first floor of the lobby uses wall mounted speakers, due to the high ceiling.

The rehearsal room is outfitted with loudspeakers, a video projector, and a plug box for recording microphones. The concert hall includes several loudspeakers, and has plugboxes throughout the stage and catwalks with connections for microphones, tie lines, intercoms, speakers, video, data, and fiber. The main audio control center is at the back of the concert hall, on the first floor under the balcony.

Lighting Redesign

Main Lobby



Space description

Important both as a gathering space and for providing access to the concert hall, the main lobby is long and relatively narrow. On one side, it has a high curtain wall, and on the other a wood paneled wall and balcony level corridor.

The north end of the lobby, by the main entrance, has a lower ceiling and contains the box office and coat check. Patrons enter through this area, and proceed through the main lobby space to enter the concert hall either on the first floor, or at the balcony level by means of stairs at each end. The southern end stairs wind around an elevator, while the northern end's instead house a small seating area.

Materials

| Type | Reflectance/transmittance (approx) |
|--------------------|------------------------------------|
| Carpet | 20% |
| Wood | 15% |
| Paint – Columns | 80% |
| Paint – Ceiling | 60% |
| Paint – Upper Wall | 40% |
| Glazing | 50% |

Design Criteria

The lobby serves two main purposes: it is a main circulation path between the main entry, black box theater lobby, and concert hall, as well as a gathering area before performances and during intermissions. Lighting levels must be designed to suit both of these uses.

Illuminance (High priority)

A prefunction area outside a concert hall may adjust its lighting levels during events to allow easier transitions between spaces. Since the lobby here is also used as a central circulation space, lighting levels during events may need to be maintained at higher than the IES recommendation.

- Horizontal (average at floor)
 - 5 fc during production
 - 15 fc pre/post production and during intermissions
 - Avg:Min = 3:1
- Vertical (average at 5 ft. AFF)
 - 3 fc during production
 - 7.5 fc pre/post production and during intermissions
 - Avg:Min = 3:1

Glare (High priority)

Since the lobby is used as a transition area from the concert hall, direct glare from light sources should be avoided. Exiting the concert hall during a performance into the brighter lobby will require some adaptation, and additional glare could be blinding.

Color Rendition

Because of the rich materials used in the lobby, color rendering will be particularly important for lights illuminating the wooden walls.

Color Temperature

As discussed above, warmer color temperatures are preferred in the concert hall. As this space is directly adjacent, it will be desirable to use the same color temperature here.

Sound

While the vestibule between the lobby and concert hall helps to block light and sound, source sound emission should still be considered. In this case, quiet noises will not be problematic, but the buzz emitted by many magnetic ballasts would be undesirable.

ASHRAE 90.1 2010

Power Allowance (Mandatory)

Lobby for performing arts theatre

- Lighting Power Density: 2.00 W/ft²

- An additional allowance of up to 1.0 W/ft² is available for decorative lighting

Automatic Shutoff (Mandatory)

An automatic control device is required to control lighting in all spaces. It must be based on either a preset schedule, occupancy sensors, or information from another control system that indicates a space is not occupied.

Display/Accent Lighting (Mandatory)

Display or accent lighting must be controlled separately from general lighting.

Automatic Daylighting Controls for Primary Sidelighted Areas (Mandatory)

In sidelighted spaces over 250 ft², lamps for general lighting must be separately controlled by a multilevel photocontrol dimming system.

Design Overview

Traditionally, the lobby of a concert hall or theater is lit with incandescent fixtures. As electricity prices rise and energy code become more strict, this strategy may become inappropriate. For the Wentz Concert Hall's lobby, I've designed it to reduce energy use by transitioning to CFL fixtures, which trade the optical control and color rendition of incandescent reflector lamps for much reduced energy use.

I've also modified the *Wentz Concert Hall* signage to be edge lit with LEDs instead of using spotlight to illuminate the entire wall. This lower amount of light and strong contrasts from the edge lighting fit the overall scheme I've used for the new lighting designs.

Figure 1: Main Lobby – First Floor North Lighting Plan

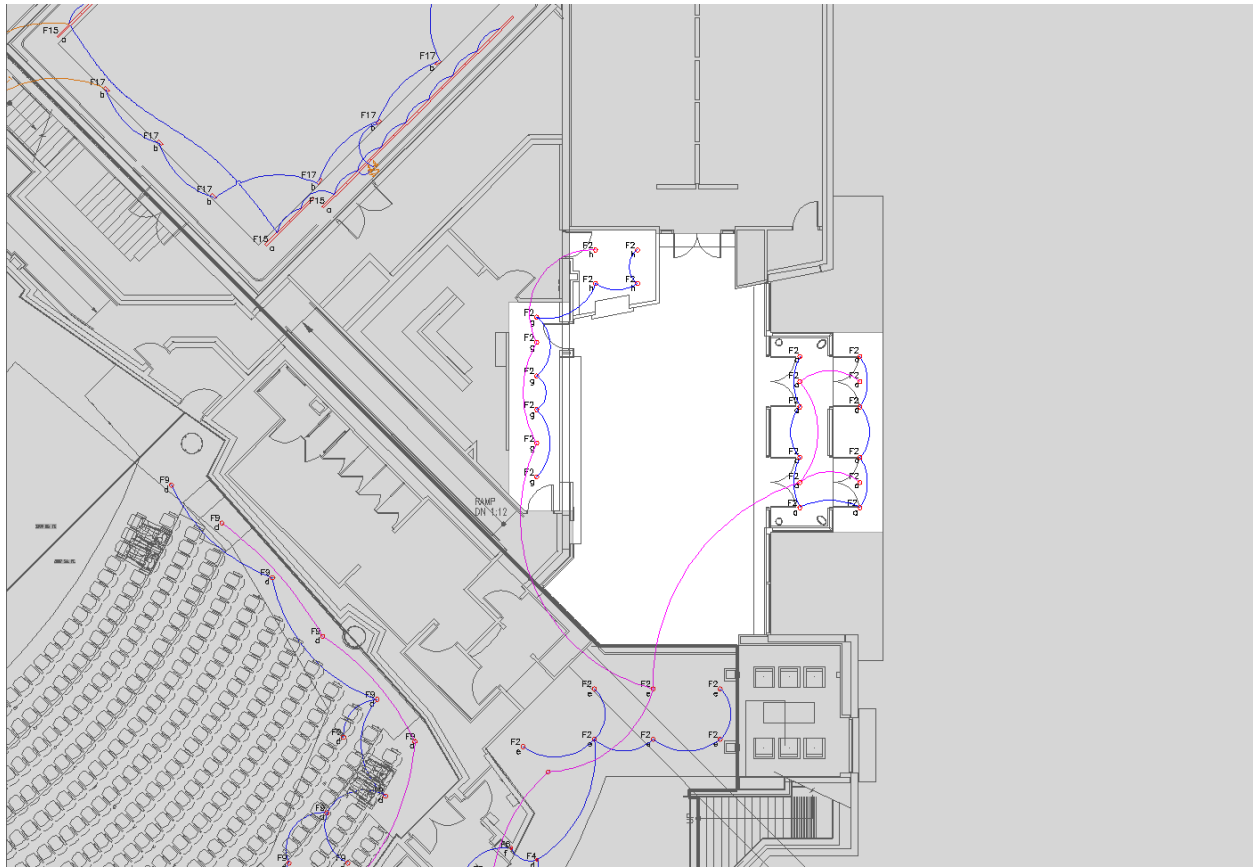


Figure 2: Main Lobby – First Floor South Lighting Plan

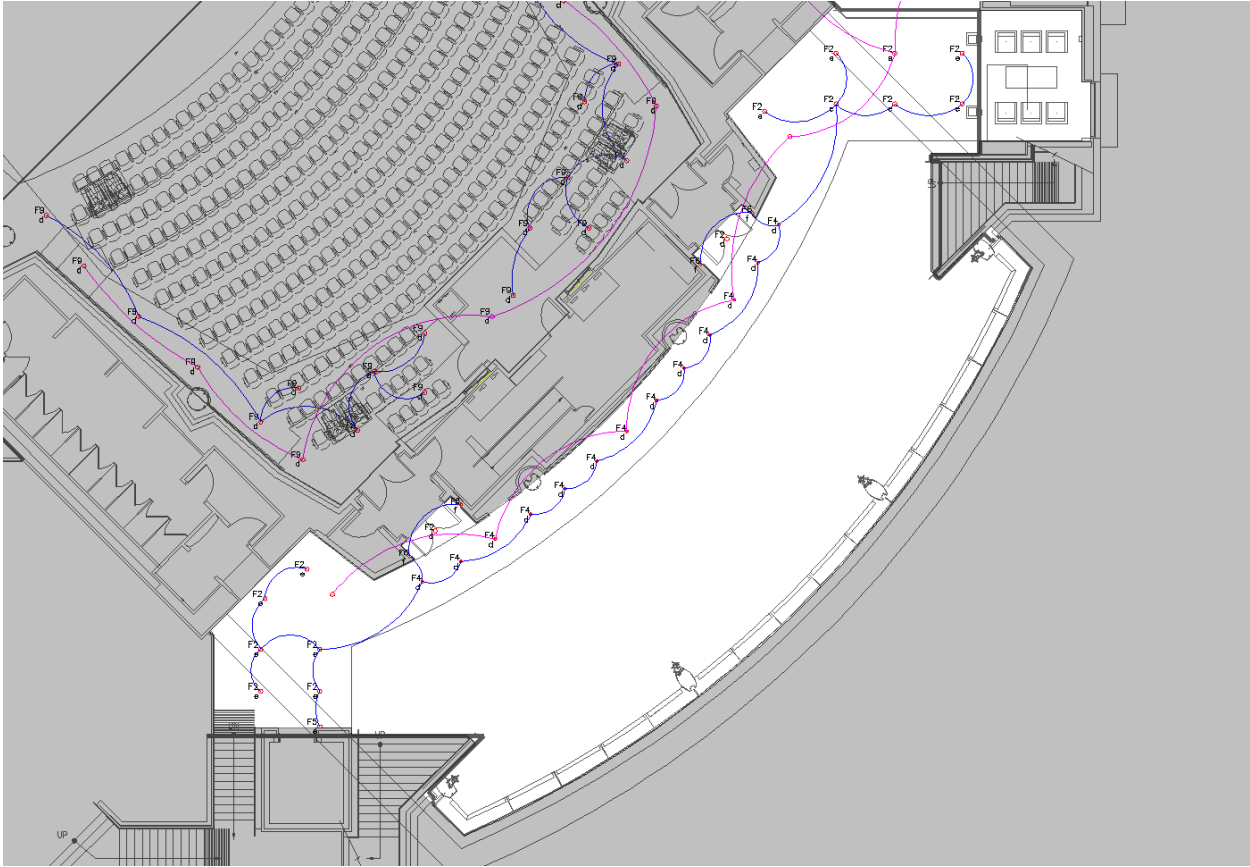


Figure 3: Main Lobby – Balcony Level North Lighting Plan

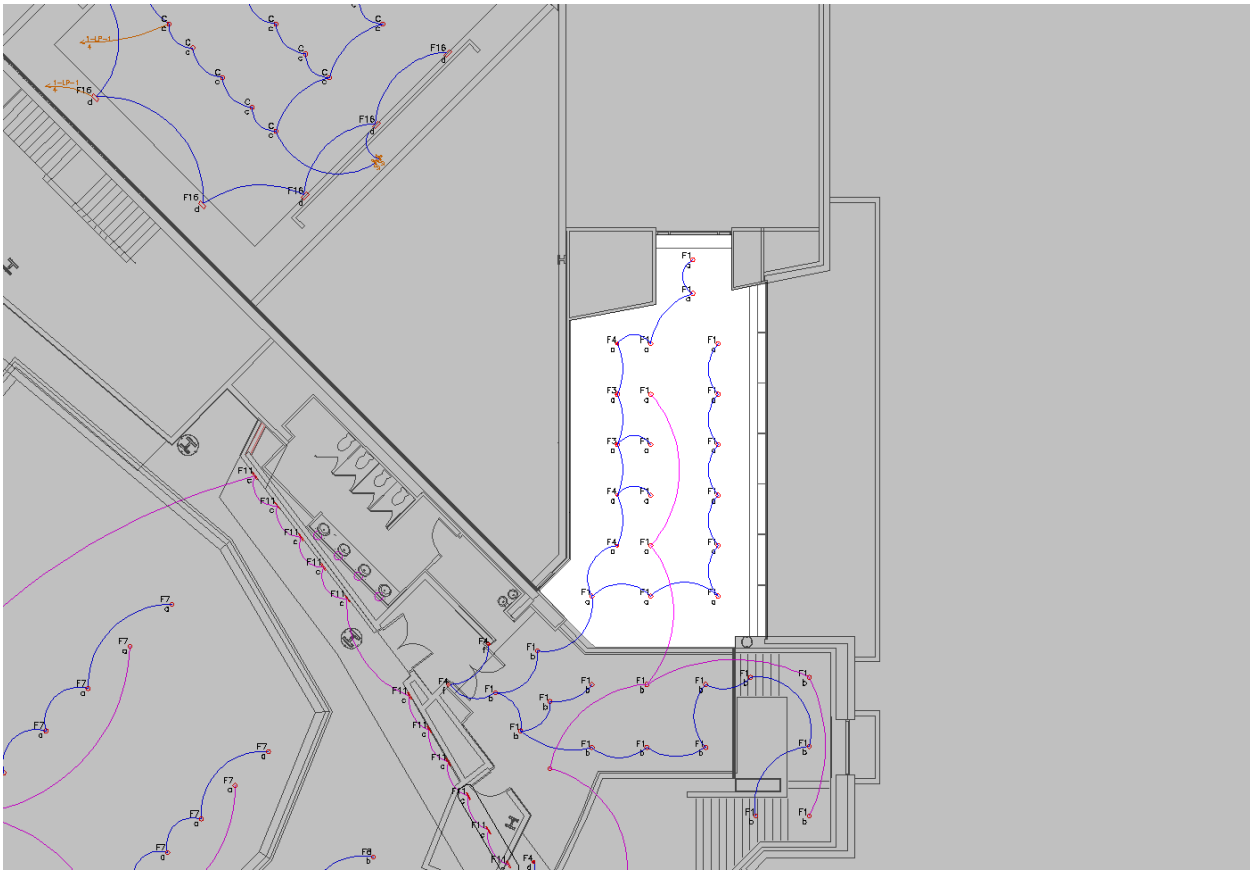
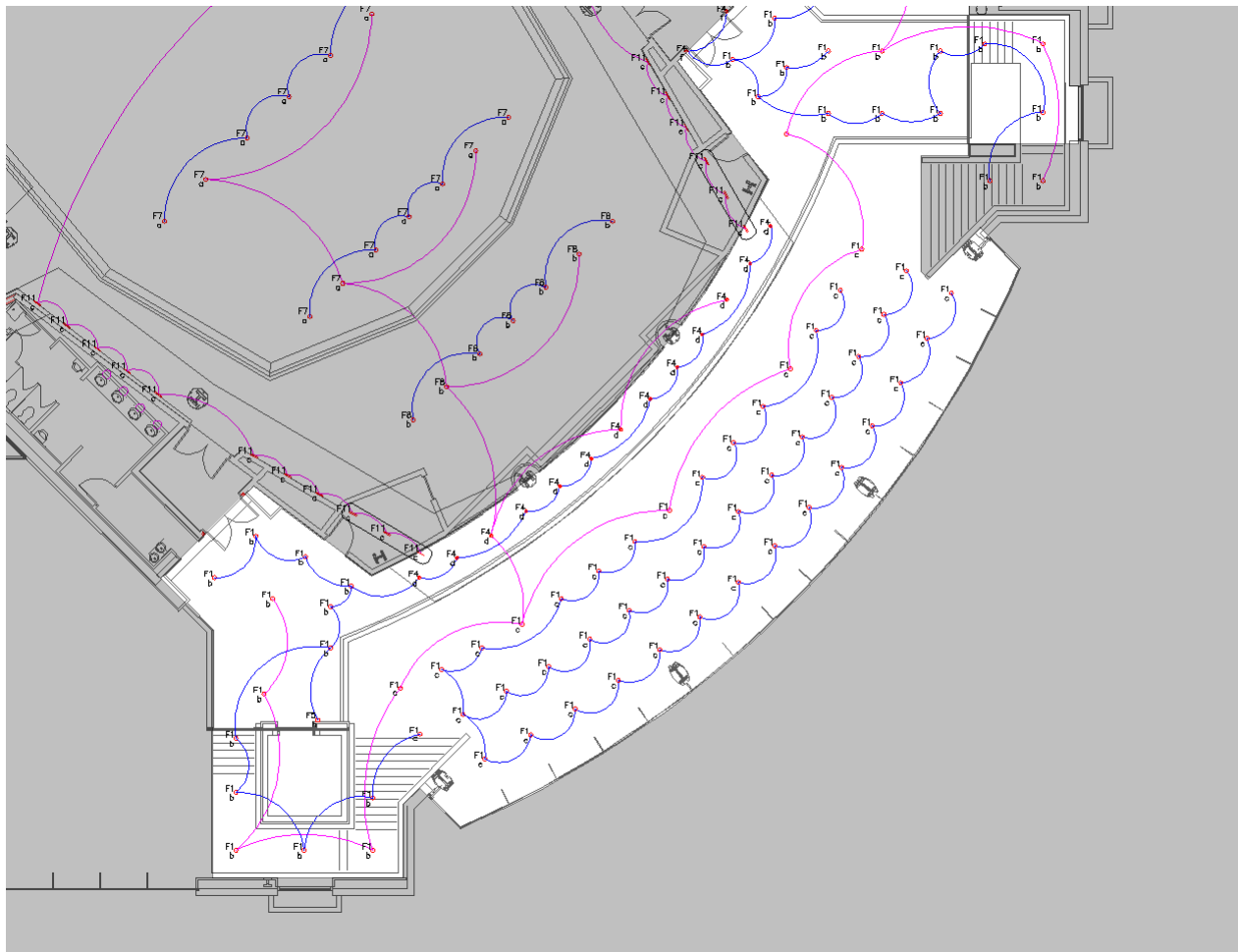


Figure 4: Main Lobby – Balcony Level South Lighting Plan



Lamp/Luminaire Selection

Most of the space uses a standard CFL downlight in various wattages to account for the high and low ceilings. The wood walls are washed using a CFL wall washer, which have a color rendering index of 82. While this won't be as ideal for the warm materials, it's consistent with the rest of the space, and is much more efficient than incandescent alternatives.

Two wall sconces are used to mark the elevator and provide a visual connection between the floors. The seating area under the north stairs will be lit with a floor and table lamp to create a more appropriate scale.

Fixture Schedule

| Type | Description | Manufacturer | Catalog Number | Lamp(s) | Input Watts |
|------|--|--------------------|------------------------------------|-------------------------------|-------------|
| F1 | Unlensed 42W compact fluorescent downlight with 6" nominal aperture, white trim, and wheat reflector | Kurt Versen | P927DM-120-W-WT | (1) F42TBX/827/A/ECO by GE | 43.2 |
| F2 | Unlensed 26W compact fluorescent downlight with 6" nominal aperture, white trim, and wheat reflector | Kurt Versen | P626DM-120-W-WT | (1) F26DBX/827/ECO4P by GE | 26.4 |
| F3 | Unlensed 42W compact fluorescent wall washer with 6" nominal aperture, white trim, and wheat reflector | Kurt Versen | P953DM-120-W-WT | (1) F42TBX/827/A/ECO by GE | 43.2 |
| F4 | Unlensed 18W compact fluorescent wall washer with 4" nominal aperture, white trim, and wheat reflector | Kurt Versen | P919DM-120-W-WT | (1) F18TBX/827/A/ECO by GE | 21.3 |
| F5 | Shielded 3' T5 wall sconce with diffuse white acrylic panel | Lightolier | 48022ALU-21W-120 | (1) F21W/T5/830/ECO by GE | 25 |
| F6 | Continuous diffuse LED strip light with dimmable driver | Birchwood Lighting | JAKE-325-TR-1-HF2N-H-30-CRx-120-CU | 54 3000K LEDs per 10" section | 5 W/ft |

Light Loss Factors

Type F1

- $LLD = 2690/3200 = 0.84$
- $LDD = 0.91$ (24 month cleaning cycle, open/unvented)
- $BF = 1.0$
- Total = 0.76

Type F2

- $LLD = 1530/1800 = 0.85$
- $LDD = 0.91$ (24 month cleaning cycle, open/unvented)
- $BF = 1.0$
- Total = 0.77

Type F3

- $LLD = 2690/3200 = 0.84$
- $LDD = 0.91$ (24 month cleaning cycle, open/unvented)
- $BF = 1.0$

- Total = 0.76

Type F4

- LLD = $1010/1200 = 0.84$
- LDD = 0.91 (24 month cleaning cycle, open/unvented)
- BF = 1.0
- Total = 0.77

Type F5

- LLD = $1930/2100 = 0.92$
- LDD = 0.91 (24 month cleaning cycle, open/unvented)
- BF = 1.0
- Total = 0.83

Type F6

- LLD = 0.8 (estimated)
- LDD = 0.91 (24 month cleaning cycle, open/unvented)
- Total = 0.73

Control System

Lobby control zones:

- a) Entry lobby downlights and wall washers
- b) Balcony level downlights
- c) Main lobby downlights
- d) First floor and balcony wall washers
- e) First floor downlights
- f) Concert hall entry LEDs
- g) Coat check
- h) Box office

Controlled by Grafik Eye 4000. See electrical section for details of control system.

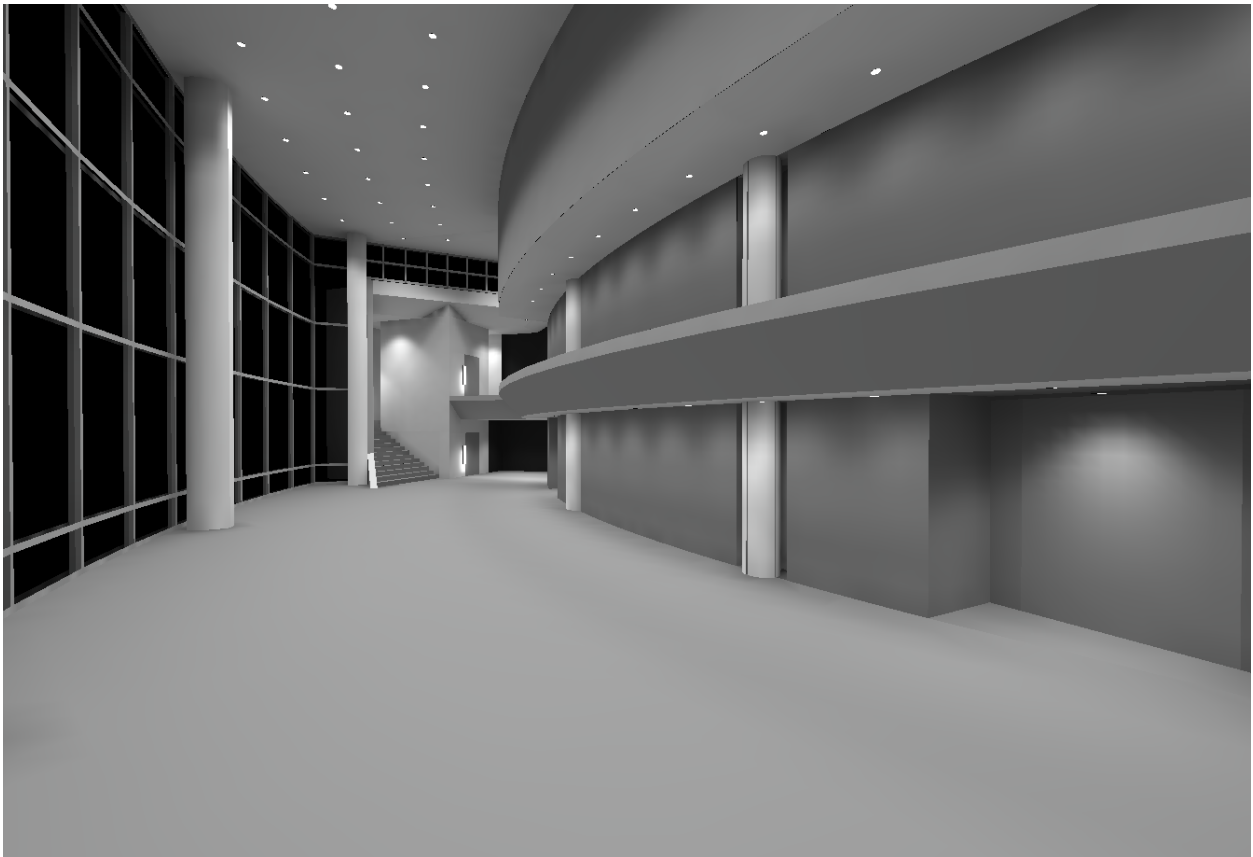
Design Performance

Figure 5: Main Lobby Rendering (north)



The large dark area in this rendering represents a transition to the art gallery, which is out of the scope of this project. As you can see, the downlights illuminate the space evenly, and wall washers highlight the wood wall on the left, as well as providing additional vertical illuminance at the coat check and box office counters.

Figure 6: Main Lobby Rendering (south)

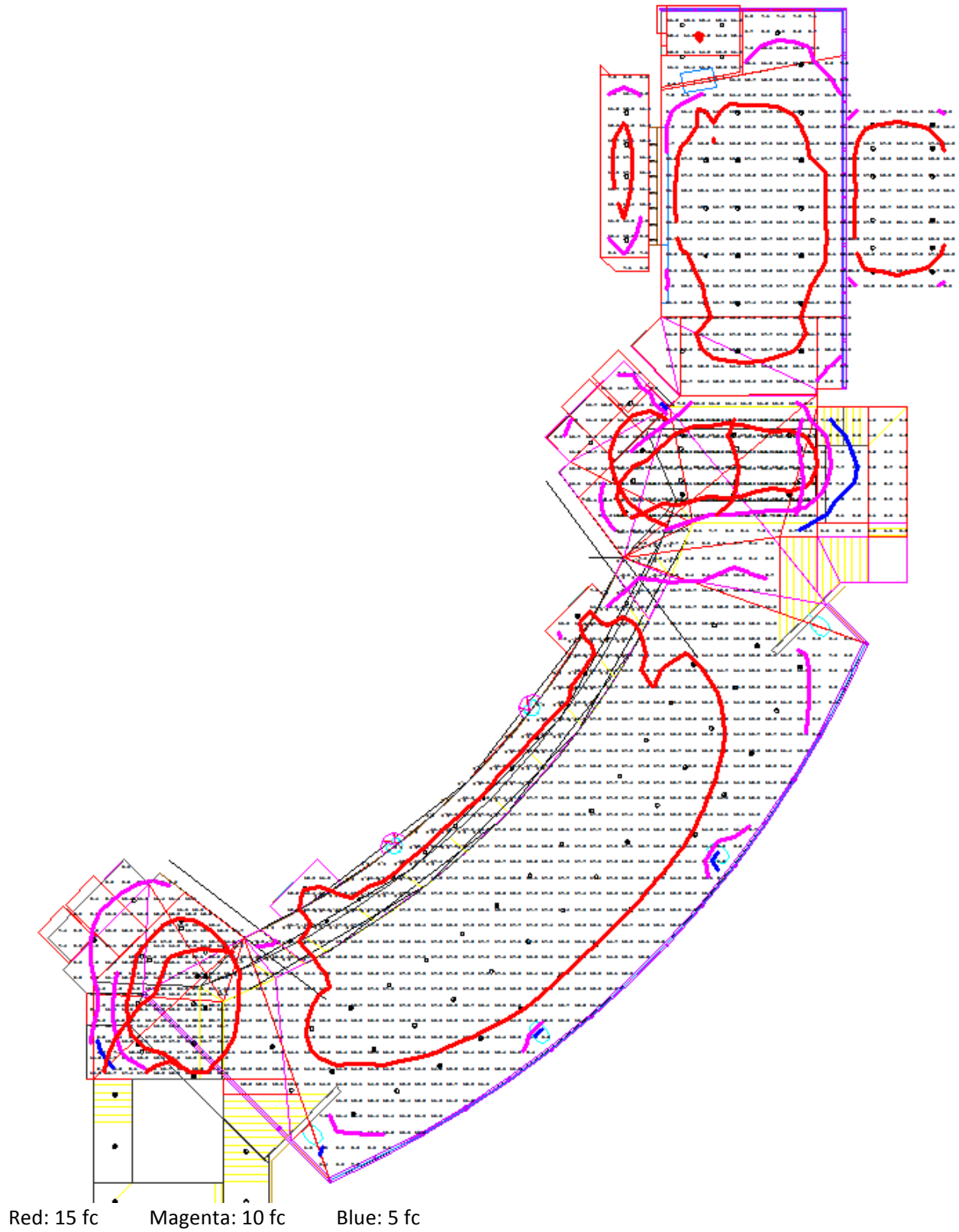


This rendering shows the larger portion of the main lobby, with one of the doors to the concert hall on the right hand side. Not illustrated are the linear seamless LED fixtures that are mounted in an arch around the door, and used to draw attention to the circulation destination. This fixture also helps tie the design of the lobby into the linear fixtures used prominently in the concert hall.

Also not included in the calculation is the large Wentz Concert Hall lettering on the upper right wall. This signage is to be lit using a flexible LED edge lighting strip, providing it with higher contrast, and avoiding shadows that would be cast by spotlights. This signage is visible from the outside, through the large curtain wall.

Circulation destinations are clearly visible: the scallop and LED arch mark the concert hall doors, a bright downlight illuminates the wall over the stairs, and a tall linear sconce visually connects the two elevator doors.

Figure 7: Main Lobby Isoillumination Lines



The blue contour line under the north stairway is a seating area which will be illuminated by a table and floor lamp. These are not included in the calculation. All other areas are satisfactory.

Lighting Power Density

| | |
|--------------------------|-----------------------|
| Area | 7,167 ft ² |
| Max Power Density | 2 W/ft ² |
| Lighting power allowance | 14.334 kW |
| Decorative allowance | 7.167 kW |

| Type | Quantity | Watts/Fixture | Type total |
|------|-----------|---------------|-----------------------|
| F1 | 83 | 43.2 | 3585.6 W |
| F2 | 40 | 26.4 | 1056 W |
| F3 | 2 | 43.2 | 86.4 W |
| F4 | 29 | 21.3 | 617.7 W |
| F5 | 2 | 25 | 50 W |
| F6 | 72.666 ft | 5 W/ft | 363.33 W (Decorative) |

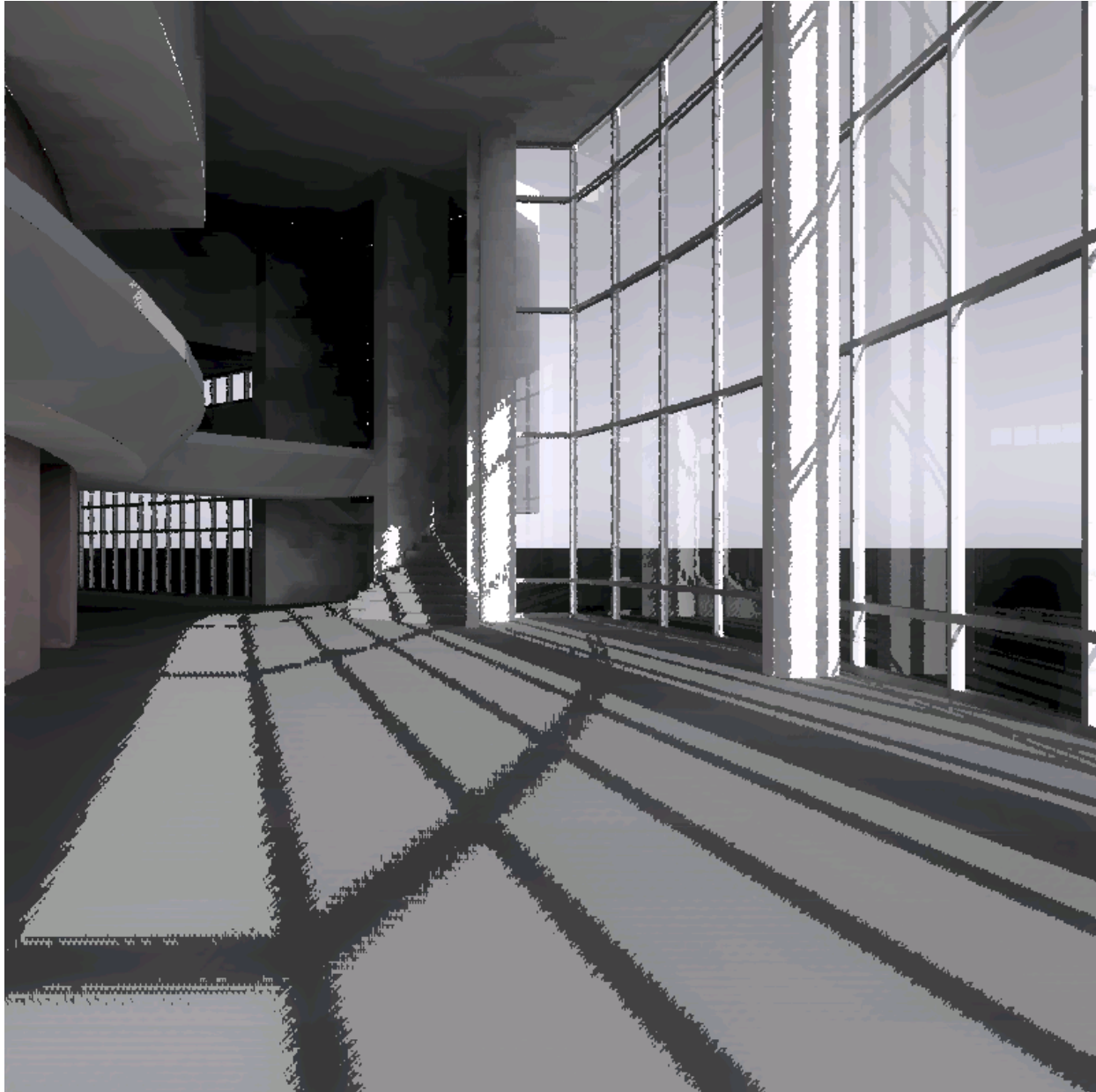
| | |
|----------------------------|-----------|
| Total lighting power | 5.3957 kW |
| Space power allowance | 14.334 kW |
| Total decorative power | 0.363 kW |
| Space decorative allowance | 7.167 kW |

Lobby meets ASHRAE 90.1 2010's lighting power density requirements for a building lobby.

Radiance Rendering (MAE Breadth)

Based on the discussions of Radiance from Flux Transfer Theory and Daylighting, I've produced a rendering of the main lobby.

Figure 8: Lobby Radiance Rendering



Concert Hall



Space description

The Wentz Concert Hall, named after Dr. Myron Wentz, is the focal point of the Wentz Concert Hall and Fine Arts Center, and the space's design plainly shows this. Spanning the first floor and balcony level, warm finishes and upholstery make the space intimate and comfortable, despite its relatively large size.

The balcony level protrudes only slightly over the back of the first floor seating, and the faceted edge of the balcony is mirrored at the perimeter below the ceiling, giving both levels a similar scale despite the wide open spaces. Curtains on the balcony level walls and behind the stage on the first floor add texture to the space, and allow for the concert hall's acoustics to be adjusted.

The walls on the first floor are finished with a textured wood panel, consisting of narrow horizontal strips, in sections that protrude various distances from the wall. The strip element is carried through the rest of the concert hall with an element on the balcony, and another series of them on the upper side walls.

Materials

| Type | Reflectance (approximate) |
|-----------------|----------------------------------|
| Carpet | 30% |
| Wood | 30% |
| Curtains | 50% |
| Paint – Walls | 60% |
| Paint – Ceiling | 80% |
| Paint – Balcony | 40% |

Design Criteria*Illuminance**Audience seating*

The main tasks performed in the audience area are wayfinding, facial recognition, and reading programs. Lighting must be sufficient for patrons to easily and safely find their seats, and must smoothly dim to the low levels required during a performance.

- Horizontal (average at floor)
 - 0.2 fc during production
 - 10 fc pre/post production and during intermissions
 - Avg:Min = 2:1
- Vertical (average at 5 ft. AFF)
 - 0.1 fc during production
 - 3 fc pre/post production and during intermissions
 - Avg:Min = 2:1

Aisles

Used for circulation by large crowds, the aisle lighting is critical for ensuring that patrons can quickly and safely navigate the concert hall. As with other lighting in the concert hall, it must also be smoothly dimmable to very low levels.

- Horizontal (average at floor)
 - 0.2 fc during production
 - 10 fc pre/post show and during intermissions
 - Avg:Min = 5:1
- Vertical (average at 5 ft. AFF)
 - 0.1 fc during production
 - 3 fc pre/post production and during intermissions
 - Avg:Min = 2:1

Control Booths

Control of light and sound is crucial to the success of an event, but it must be done without lighting that would be distracting to the audience. To this end, control panels are frequently backlit to alleviate the need for supplemental lighting.

- Horizontal (average at floor)
 - 0.2 fc during production
 - 20 fc pre/post production and during intermissions
 - Avg:Min = 2:1

Isolation (High priority)

Given the importance of a dark environment in the concert hall during productions, care must be taken to prevent light from external sources into the space.

Glare (High priority)

Direct glare from light sources should be avoided, since it could interfere with adaptation to the low light levels. Bright light sources detract attention from the intended focus on the stage.

Color Rendition

Good color rendering is important for stage lighting, and using sources with similar color rendering throughout the space will maintain uniform appearance of room finishes.

Color Temperature

Warm materials are used throughout the space, and a similarly warm color temperature should be selected for light sources.

Sound

As the concert hall is an acoustically sensitive environment, sources should be selected to avoid background noise generation.

ASHRAE 90.1 2010

Power Allowance (Mandatory)

Permanent audience / seating area for performing arts theatre

- Lighting Power Density: 2.43 W/ft²
- Theatrical lighting equipment is exempt from this allowance, the full amount is available for architectural lighting purposes
- An additional allowance of up to 1.0 W/ft² is available for decorative lighting

Automatic Shutoff (Mandatory)

An automatic control device is required to control lighting in all spaces. It must be based on either a preset schedule, occupancy sensors, or information from another control system that indicates a space is not occupied.

Display/Accent Lighting (Mandatory)

Display or accent lighting must be controlled separately from general lighting.

Design Overview

The concert hall's architecture is strongly linear, with horizontal elements throughout. These include the wood paneling on the walls, wooden strips across the reverberation chamber's screen, matching strips on the balcony level walls, and a number of architectural shelves designed to match the angular profile of the balcony level's edge.

My lighting solution seeks to reduce energy usage by using glowing linear fixtures to accent these features, rather than illuminating the walls with energy-intensive incandescent wall washers or grazers. To this end, I've selected two LED fixtures: a 3.5" continuous linear fixture with a diffuse lens, and an architectural neon replacement that can be easily surface mounted for smaller accents. These two fixtures are integrated into horizontal elements, defining the space while directing audience attention forward to the stage, where walls are brightly lit.

Figure 9: Concert Hall – First Floor Lighting Plan

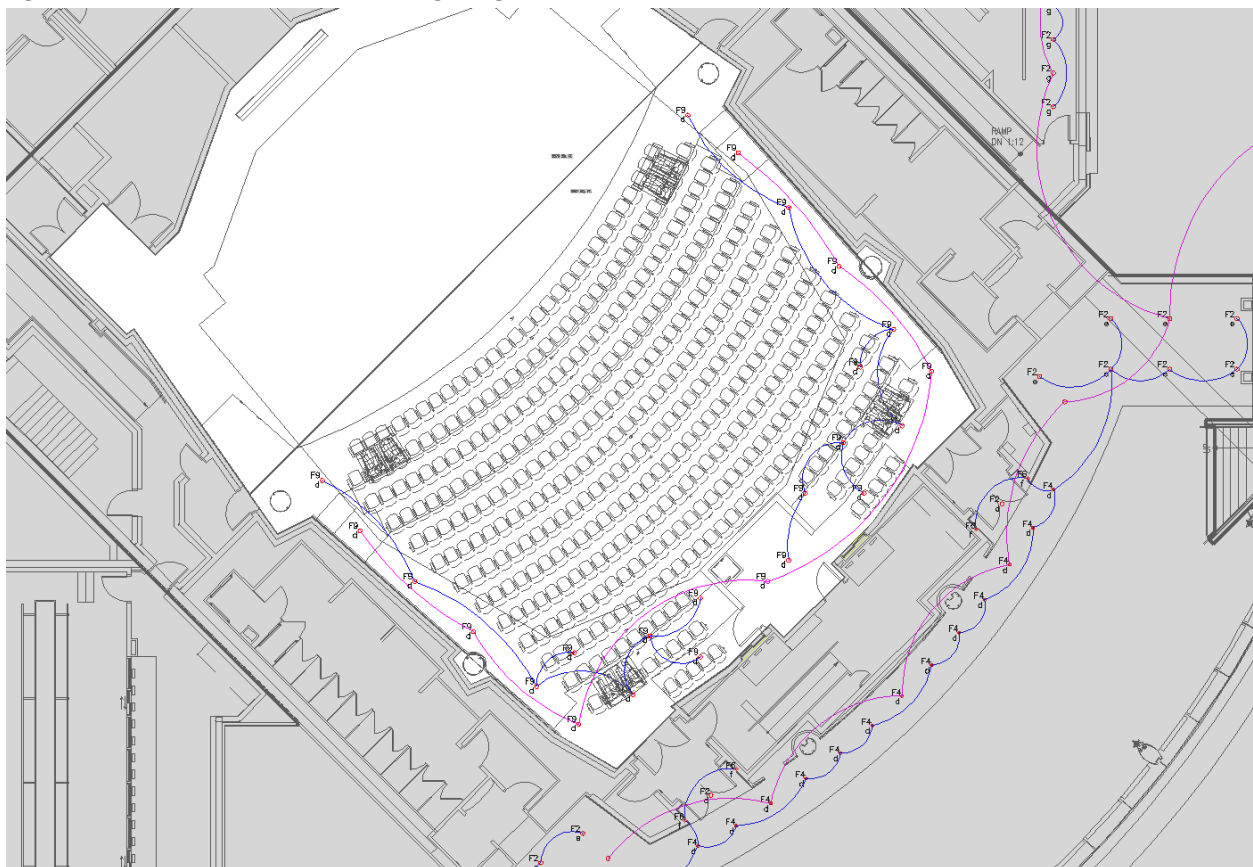


Figure 10: Concert Hall – Balcony Level Lighting Plan

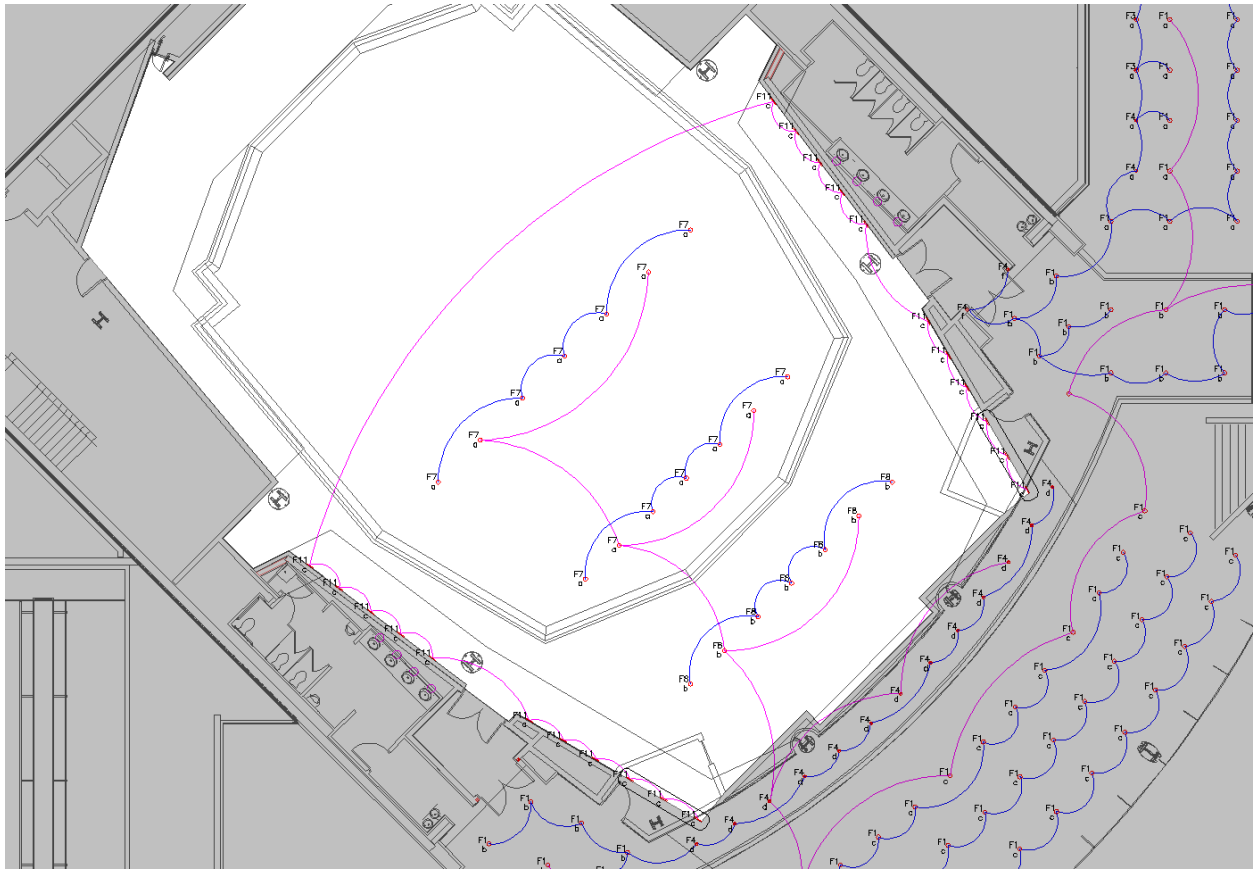
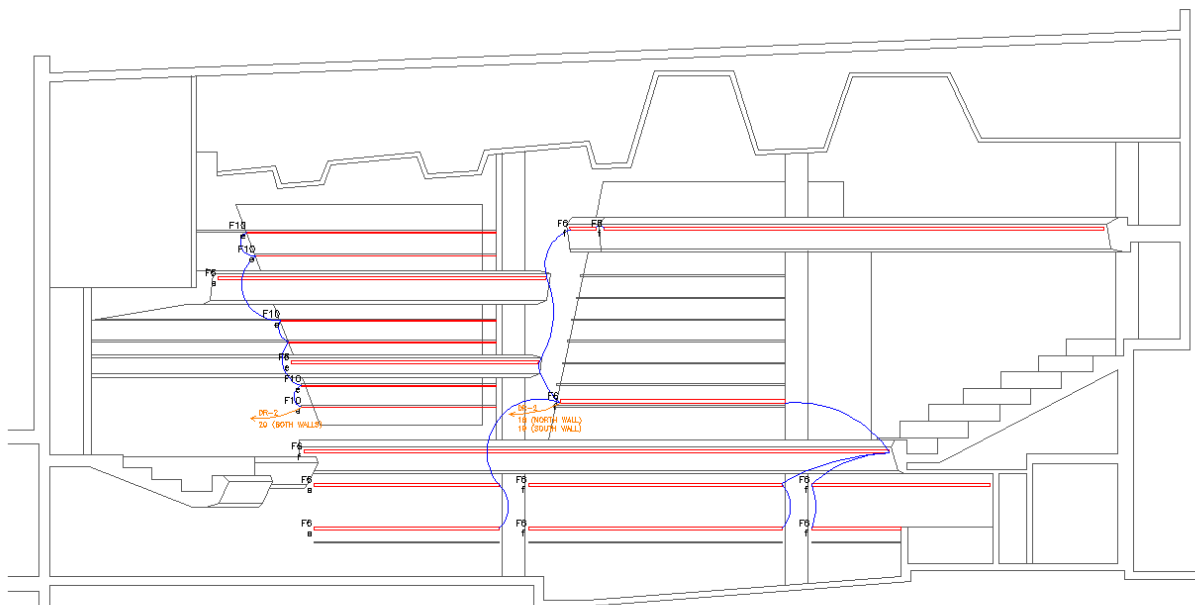


Figure 11: Concert Hall – Wall Lighting Plan



Lamp/Luminaire Selection

The primary source of light in the space is halogen incandescent downlights with PAR38 and PAR30 lamps in the upper ceiling and below the balcony. These are selected to provide light with the same color temperature and spectral distribution as the stage lights so that the room's materials will be rendered uniformly throughout.

Additional lights are LED based, including steplights for the balcony aisle where the catwalks above wouldn't allow for maintenance access to downlights. A 3.5" linear strip with a continuous diffuse lens is used as a primary architectural accent light, with smaller accents provided by an LED neon-replacement fixture. This allows for easier installation, while providing a similar linear glow.

Fixture Schedule

| Type | Description | Manufacturer | Catalog Number | Lamp(s) | Input Watts |
|------|--|--------------------|------------------------------------|-------------------------------|-------------|
| F7 | Top relampable 250W PAR38 halogen downlight with white trim | Kurt Versen | C7302-W-WT | 250PAR38HALFL30 by Sylvania | 250 |
| F8 | Top relampable 90W PAR38 halogen downlight with white trim | Kurt Versen | C7302-W-WT | 90PAR/FL25XL-EG by GE | 90 |
| F9 | Top relampable 75W PAR30 halogen downlight with white trim | Kurt Versen | C7301-W-WT | 75PAR30/H/FL35 by GE | 75 |
| F6 | Continuous diffuse LED strip light with dimmable driver | Birchwood Lighting | JAKE-325-TR-1-HF2N-H-30-CRx-120-CU | 54 3000K LEDs per 10" section | 5 W/ft |
| F10 | Linear LED neon-replacement with diffuse white light guide and dimmable driver | GE | GEWWXNLE1-30K-A | 3000K LEDs | 3.39 W/ft |
| F11 | LED steplight with black front-plate, fully shielded aperture, and dimmable driver | Cole Lighting | L-2158-BLK | 6W 3000K integrated LED | 8 |

Light Loss Factors

Type F7

- 0.8 (estimated)

Type F8

- 0.8 (estimated)

Type F9

- 0.8 (estimated)

Type F6

- LLD = 0.8 (estimated)
- LDD = 0.91 (24 month cleaning cycle, open/unvented)
- Total = 0.73

Type F10

- 0.8 (estimated)

Type F11

- 0.8 (estimated)

Control System

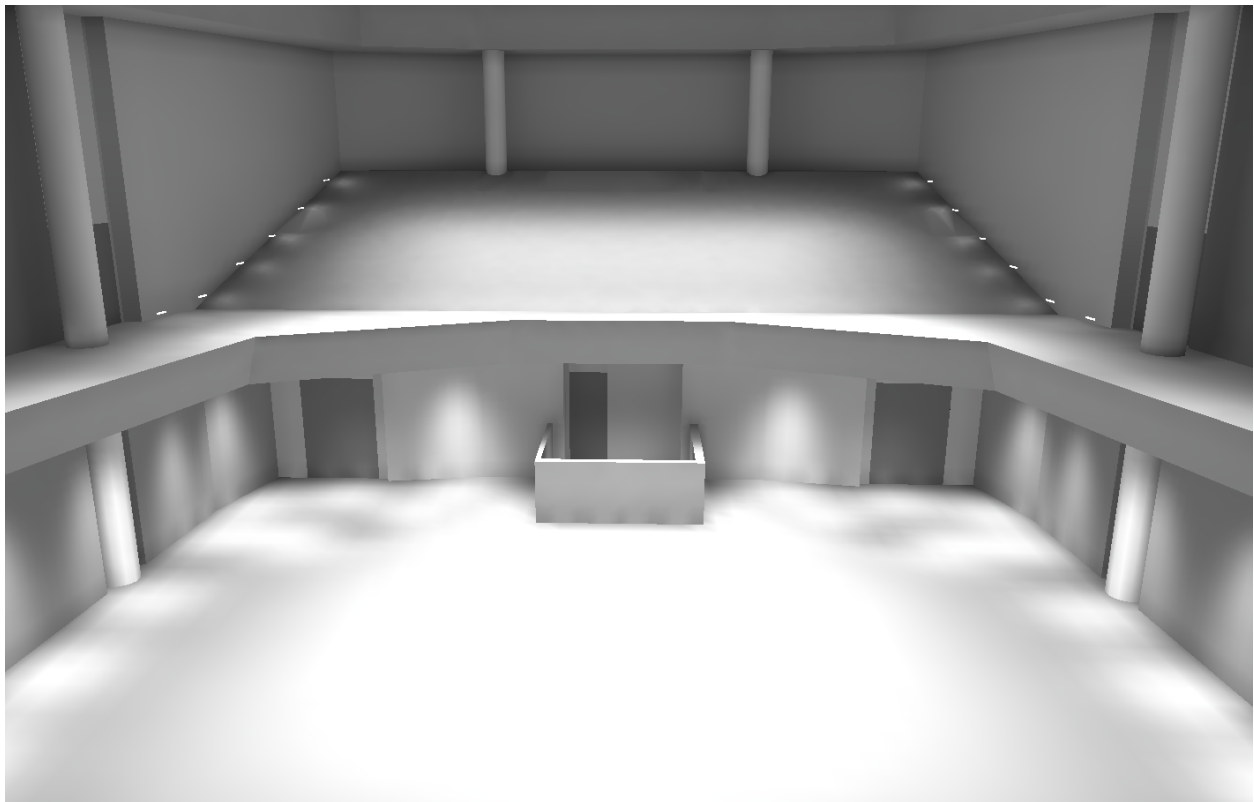
Concert hall control zones:

- a) Upper downlights (for first floor seating)
- b) Upper downlights (for balcony seating)
- c) Balcony steplights
- d) First floor downlights
- e) Front linear LEDs
- f) Other linear LEDs

Controlled by Grafik Eye 4000. See electrical section for details of control system.

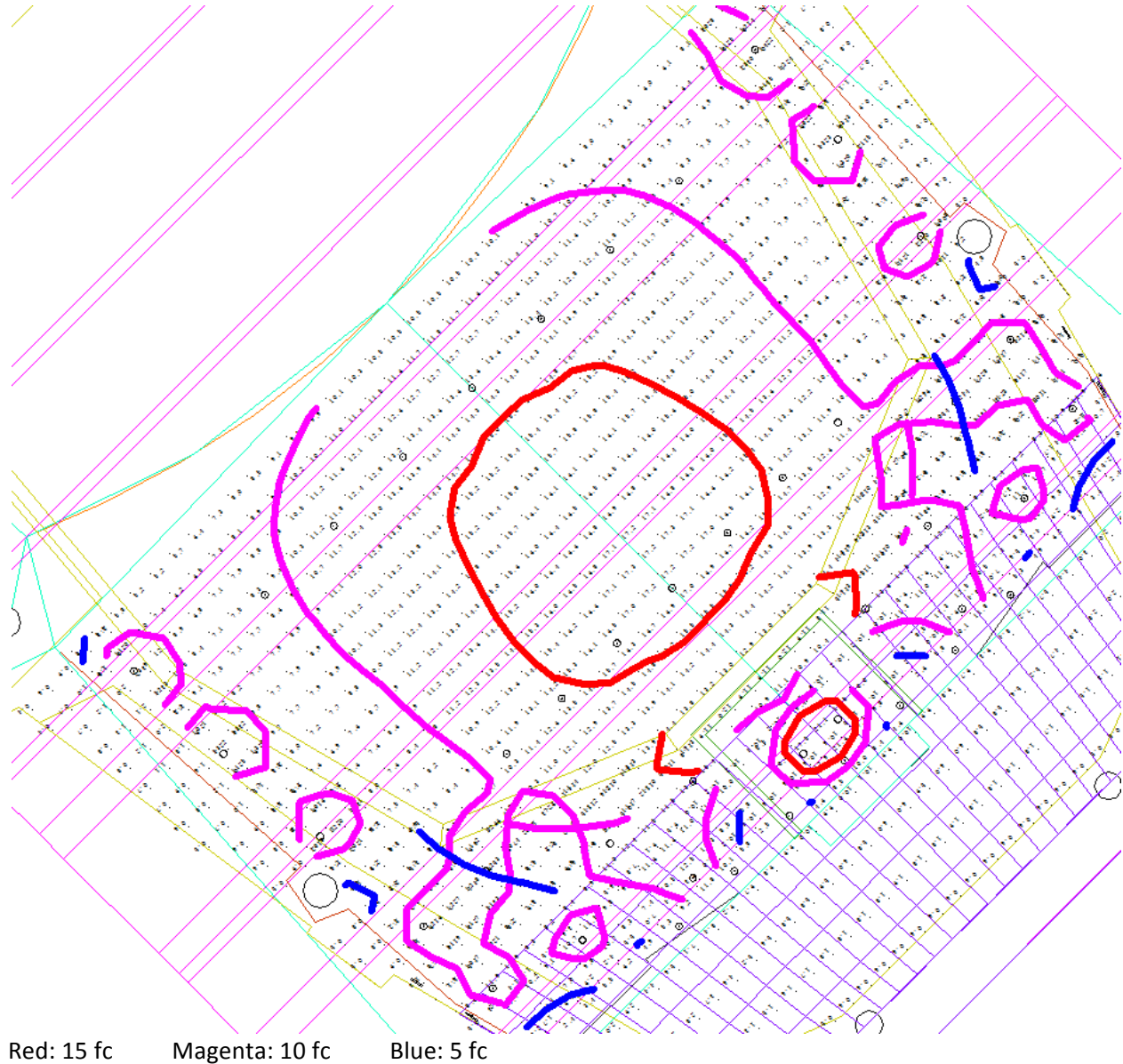
Design Performance

Figure 12: Concert Hall Light Levels



As you can see in the above rendering, the first floor is brightly illuminated. The balcony relies on steplights for the aisles because the ceiling isn't accessible from catwalks at the edge to relamp downlights. Note that the light level calculation only includes the general illumination, decorative linear fixtures were not calculated because photometry information was not available.

Figure 13: Concert Hall Isoilluminance Lines



The concert hall's audience seating area targets 10 fc, marked by the magenta lines, and it achieves that out to almost the edge of the seating area. In the center it reaches 15 fc because the catwalk's limited accessible ceiling area restricts lighting at the edges of the space. The illuminance averages 11 fc, and drops to 6 fc at some points at the edge of the seating area, within the target 2:1 average:minimum ratio.

It peaks in the rear at the control booth, with light levels in the range of 15-20 fc, as desired at full output.

Lighting Power Density

| | |
|--------------------------|------------------------|
| Area (audience only) | 5,921 ft ² |
| Max Power Density | 2.43 W/ft ² |
| Lighting power allowance | 14.388 kW |
| Decorative allowance | 5.921 kW |

| Type | Quantity | Watts/Fixture | Type total | |
|------|----------|---------------|------------|--------------|
| F7 | 14 | 250 | 3500 W | |
| F8 | 7 | 90 | 630 W | |
| F9 | 24 | 75 | 1800 W | |
| F6 | 654 | 5 W/ft | 3270 W | (Decorative) |
| F10 | 280 | 3.39 W/ft | 949.2 W | (Decorative) |
| F11 | 22 | 8 | 176 W | |

| | |
|----------------------------|-----------|
| Total lighting power | 6.106 kW |
| Space power allowance | 14.388 kW |
| Total decorative power | 4.219 kW |
| Space decorative allowance | 5.921 kW |

The concert hall meets ASRAE 90.1 2010's power density requirements for an audience seating area.

Acoustical Breadth

The existing design uses adjustable curtains for acoustical control, allowing it to achieve a range of sound qualities to suit different types of performances. But the concert hall has a very linear architectural style, and everything else in the space is designed with hard edges. What adjustable acoustical control options could be used as an alternative?

The reverberation time, a simple metric used to summarize the acoustical performance of a space, depends on the room's volume and its total sound absorption. With the current system, absorption is modified by moving the curtains out from compartments at the back, allowing them to absorb sound that would have been reflected by the walls behind them. Can a comparable range of reverb times be achieved by changing the room's volume?

The best way to do this is by using reverberation chambers with movable wall panels. The concert hall has two reverberation chambers at the front on the balcony level. Their acoustics are adjusted by curtains across their back walls, but the volume can't be closed off from the rest of the concert hall.

The ideal reverberation time for a concert hall of this size is approximately 2 seconds at middle frequencies (500-1000 Hz). I will perform my calculations for sound at 500 Hz.

$$a_{\text{total room absorption}} = \sum(S\alpha), \text{ where } S = \text{surface area and } \alpha = \text{surface absorption coefficient}$$

T_{60} , the time for a sound to decay by 60 decibels, is calculated by $T_{60} = 0.05V/a$.

Room volume: 369500 ft³ with reverberation chambers
310026 ft³ without reverberation chambers

Base Case (Chambers open, curtains hidden)

| | Area (ft ²) | Material | Absorption Coefficient |
|-----------------|-------------------------|--|------------------------|
| 1st floor Walls | 4,095 | 1/2" Gyp. Board on 2x4s | 0.05 |
| 2nd Floor Walls | 15,032 | 1/2" Gyp. Board on 2x4s | 0.05 |
| Ceiling | 7,289 | 1/2" Gyp. Board | 0.05 |
| Stage | 2,373 | Wood | 0.10 |
| Audience | 2,412 | Audience in upholstered seats | 0.80 |
| Floor | 1,284 | Heavy carpet on concrete | 0.14 |
| | | $\Sigma(\text{Area} \times \text{Absorption})$ | 3667 Sabins |
| | | Reverberation Time | 5.03 seconds |

Reverberation Chambers Closed

| | Area (ft ²) | Material | Absorption Coefficient |
|-----------------|-------------------------|--|------------------------|
| 1st floor Walls | 4,095 | 1/2" Gyp. Board on 2x4s | 0.05 |
| 2nd Floor Walls | 11,856 | 1/2" Gyp. Board on 2x4s | 0.05 |
| Ceiling | 7,289 | 1/2" Gyp. Board | 0.05 |
| Stage | 2,373 | Wood | 0.1 |
| Audience | 2,412 | Audience in upholstered seats | 0.8 |
| Floor | 1,284 | Heavy carpet on concrete | 0.14 |
| | | $\Sigma(\text{Area} \times \text{Absorption})$ | 3508 Sabins |
| | | Reverberation Time | 4.41 seconds |

Curtains Exposed

| | Area (ft ²) | Material | Absorption Coefficient |
|-----------------|-------------------------|--|------------------------|
| 1st floor Walls | 3,695 | 1/2" Gyp. Board on 2x4s | 0.05 |
| 2nd Floor Walls | 14,232 | 1/2" Gyp. Board on 2x4s | 0.05 |
| Ceiling | 7,289 | 1/2" Gyp. Board | 0.05 |
| Stage | 2,373 | Wood | 0.1 |
| Audience | 2,412 | Audience in upholstered seats | 0.8 |
| Floor | 1,284 | Heavy carpet on concrete | 0.14 |
| Curtains | 1,200 | Mediumweight drapery | 0.49 |
| | | $\Sigma(\text{Area} \times \text{Absorption})$ | 4195 Sabins |
| | | Reverberation Time | 4.40 seconds |

As you can see, closing off the additional reverberation volume has almost the exact same effect as adding 1,200 ft² of mediumweight drapery. The calculated reverberation times are higher than expected, probably due to poor approximations of the materials in my calculation. If the walls were more absorptive than I've estimated, the relative effect of the curtains would actually be decreased.

Regardless, this demonstrates that the volume of reverberation chamber in the Wentz Concert Hall is sufficient to be useful in adjusting its acoustical properties. A reflective panel placed behind the screen would let changes be made with no visible distraction from the architecture.

Architectural Breadth

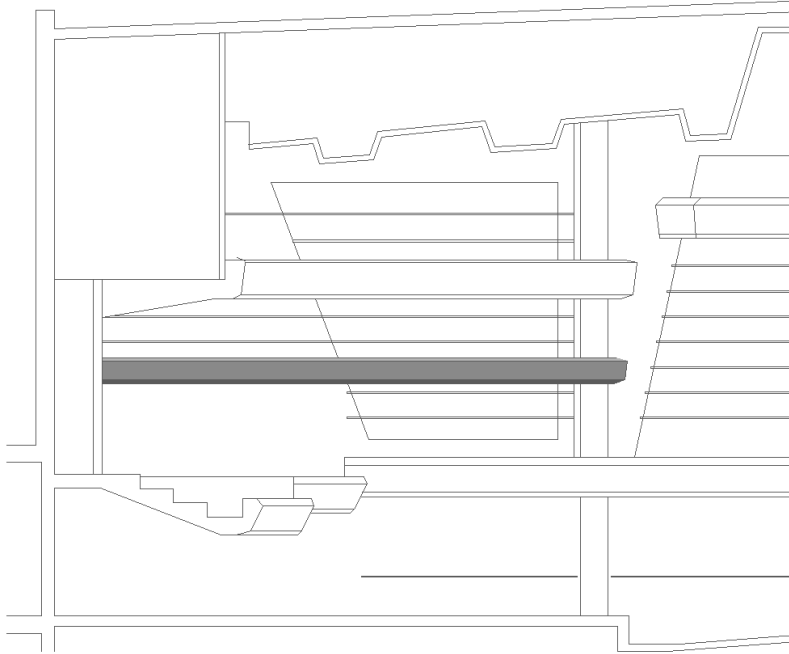
As has been mentioned before, the concert hall has many horizontal lines. These help to direct attention toward the stage at the front, but they also mean there isn't a strong definition of the boundary between the stage and audience. For my architectural breadth, I've attempted to give this transition more spatial definition, without disrupting the room as a whole.

Figure 14: Original Concert Hall Design



You can see in the figure above that the beginning of the stage is marked by a column, which is followed by the screen into the reverberation chamber. The strong vertical of the column is a disruption of the flow of attention toward the front of the room.

Figure 15: Revised Elevation



My solution to this is to add a third shelf level, smaller than the balcony's edge and the upper shelf, above head level of a person walking along the balcony. This visually breaks up the column so that it no longer dominates the view from the audience, and creates a visual arch form using the three shelf levels and the ceiling. This arch over the stage visually separates it from the rest of the space, while avoiding a sharp transition, and ties the concert hall together more strongly than the original design.

The new shelf also serves as location to integrate wide LED strip, as seen in the concert hall lighting elevation.

Facade

Space description

The building's façade is primarily finished with architectural precast concrete in a warm yellow. It's mostly smooth with a pattern of horizontal lines, but is broken by several wide rusticated strips. At night, most of the façade's appearance comes from the inside, with light shining out from its two large lobbies.

Cornices around the two lobby masses protrude several feet at a 45° angle, and are finished with aluminum panels.

Design Criteria

Illuminance (High Priority)

Façade illuminance criteria are as recommended for an area of medium night activity and LZ3 lighting zone.

Facade

- Vertical
 - 7.5 fc maximum, to highlight façade details or features
 - Apply to <20% of façade
 - 3 fc average for large illuminated areas

Entry

- Horizontal (average at grade)
 - 1.5 fc
 - Avg:Min = 2:1
- Vertical (average at 5 ft. above grade)
 - 0.8 fc
 - Avg:Min = 4:1

Wayfinding

The main entry is the primary destination for most people entering the building, though some will also be entering at the black box theater lobby. Since many visitors may not be familiar with the building, lighting can be used as a wayfinding aid.

Landmark Appearance (High Priority)

The bright lobby with its Wentz Concert Hall lettering makes a powerful landmark, which will help patrons recognize the building even if they have never seen it before. Exterior lighting should avoid overpowering this effect.

Light Pollution/Trespass

Exterior lighting should minimize light trespass to adjacent properties and light emitted upward.

ASHRAE 90.1 2010

Power Allowance (Mandatory)

Lighting Zone 3:

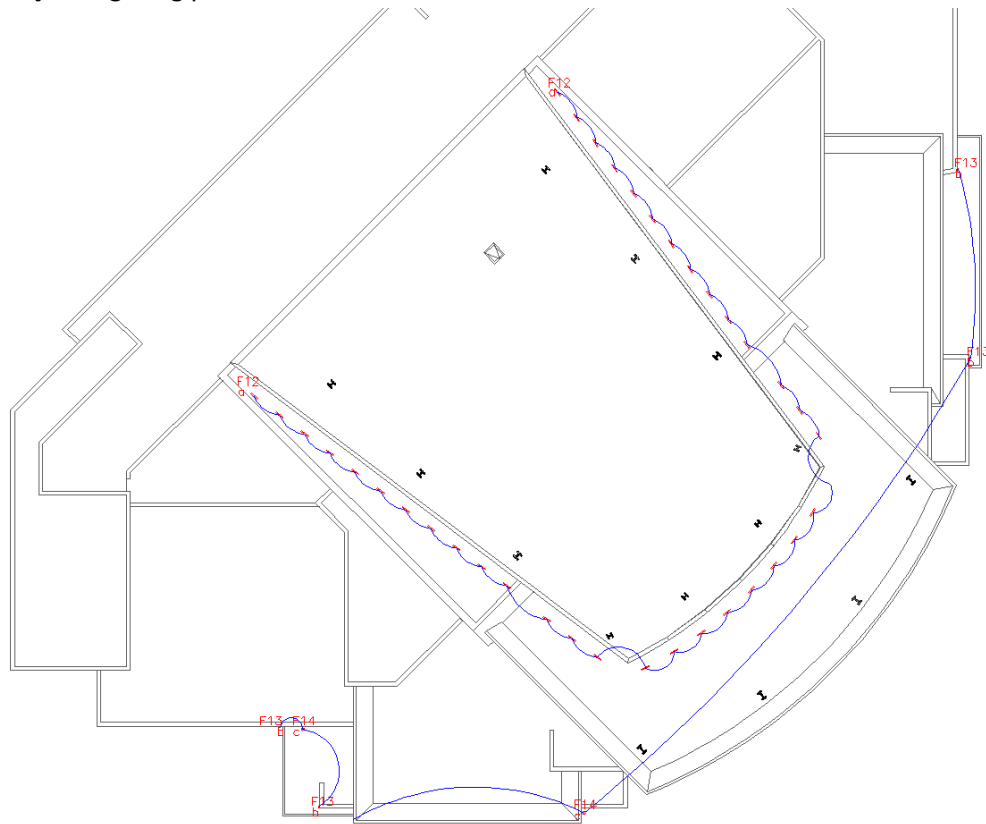
- Tradable allowances
 - 30 W/ft of main entrance width
 - 20 W/ft of other door width
 - 0.4 W/ft² of entry canopies
- Non-tradable allowances
 - 3.5 W/ft of illuminated facade

Design Overview

The façade's most attention-grabbing features are the large main lobby and the Madden Theater lobby, both of which have large curtain walls, and are visible from outside the building at night. Lighting the walls adjacent to these spaces would reduce their visual impact, so the walls on the lower floors are left dark.

Instead, color changing LED strips illuminate the high wall above the concert hall. This makes it instantly recognizable as a landmark from a large distance. Narrow beam LED fixtures near the entrances give more form to the building without floodlighting the walls, and they allude to the linear lighting designs of the interior.

Figure 16: Façade lighting plan



Lamp/Luminaire Selection

The upper wall is lit using a linear 4' RGB LED fixture, which will have a long operating life and allow the color to be cycled much more easily than with permanently colored filters. Since these mix light by adding the wavelengths they need instead of filtering out unwanted colors, they're also much more energy efficient.

For additional accent near the entries, a small LED up/downlight with symmetrical 10° degree beams mimics the impression from the linear fixtures used inside, but without requiring large penetrations and large wet-rated enclosures. Downlighting under the canopy is performed with standard fluorescent fixtures.

Fixture Schedule

| Type | Description | Manufacturer | Catalog Number | Lamp(s) | Input Watts |
|------|---|-----------------|----------------------|----------------------------|-------------|
| F12 | Color changing linear LED fixture with 30x60 degree beam distribution in 2' nominal lengths. IP66 rated for outdoor use | Color Kinetics | 123-000030-03 | RGB LEDs | 35 |
| F2 | Unlensed 26W compact fluorescent downlight with 6" nominal aperture, white trim, and wheat reflector | Kurt Versen | P626DM-120-W-WT | (1) F26DBX/827/ECO4P by GE | 26.4 |
| F13 | Wall mounted LED grazer with 10° up and down beams | Beta-Calco | 66-2201 | (2) 3800K white LEDs | 4.5 |
| F14 | Wet rated cylindrical up/downlight, wall mounted with convex lens | Delray Lighting | 242-BM-CUV8242.1E-WL | (2) F42TBX/830/A/ECO by GE | 43.2 |

Light Loss Factors

Type F12

- Total = 0.8 (estimated)

Type F2

- LLD = $1530/1800 = 0.85$
- LDD = 0.91 (24 month cleaning cycle, open/unvented)
- BF = 1.0
- Total = 0.77

Type F13

- Total = 0.8 (estimated)

Type F14

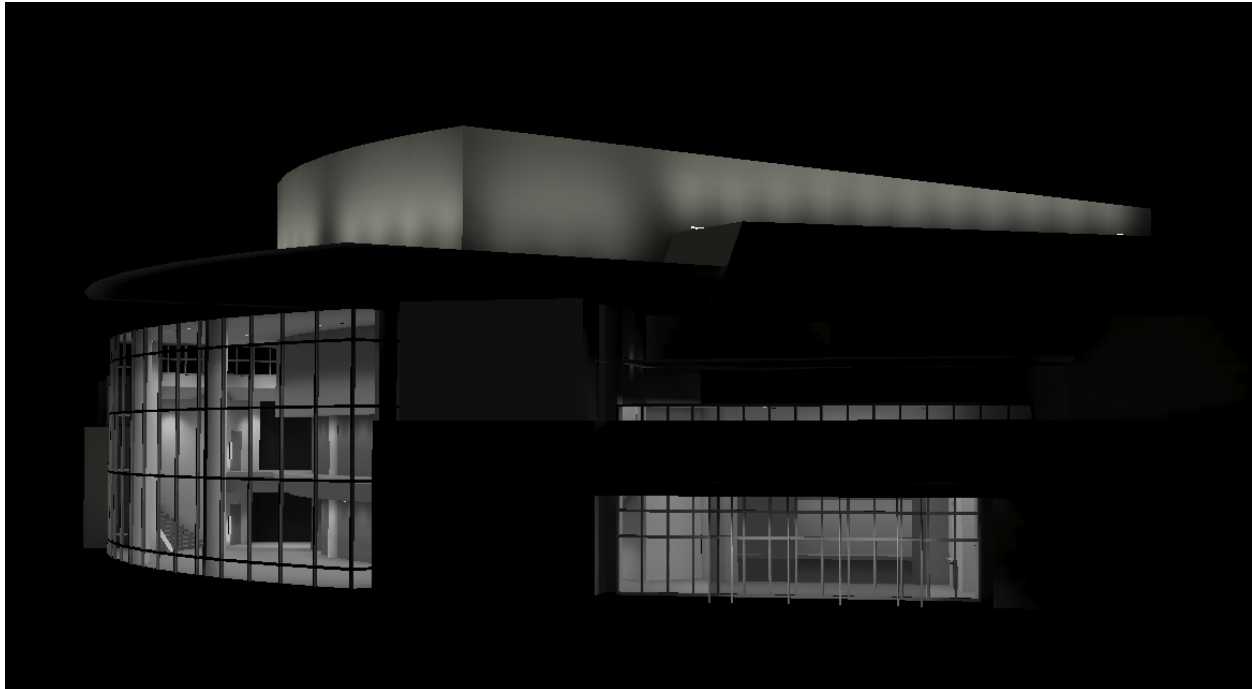
- LLD = $2690/3200 = 0.84$
- LDD = 0.79 (24 month cleaning cycle, moderate dirt level)
- BF = 1.0
- Total = 0.66

Control System

The exterior lighting at the entrances are controlled with the vestibule lighting from the lobbies. Color changing LED fixtures are tied to the Grafik 4000 controls, and are managed using preset scenes.

CFL side Design Performance

Figure 17: Façade Rendering



The exterior lighting doesn't meet the IES recommended illuminance, coming in at 1.5 fc rather than the 3 fc target for large illuminated areas. This is due in part to the way the energy code is structured, where façade power allowance is based only on the illuminated walls. No additional power is freed for use by choosing to leave the majority of the building unilluminated, because the façade lighting allowance is untradeable.

The entry downlights, which are calculated in conjunction with the main lobby (north portion), can exceed the IES recommended 1.5 fc, but are on a dimming system and can be reduced. This will allow it to be brightly lit to welcome guests to a performance, but turned down as people are leaving with their eyes adjusted to the performance's lowered light levels.

Lighting Power Density

Tradable Allowances

| | |
|------------------------|-----------------------|
| Main entrance width | 24 ft |
| Allowance | 30 W/ft |
| Total other door width | 72 ft |
| Allowance | 20 W/ft |
| Entry canopy area | 333 ft ² |
| Allowance | 0.4 W/ft ² |
| Façade power allowance | 2.293 kW |

| Type | Quantity | Watts/Fixture | Type total |
|-------------|-----------------|----------------------|-------------------|
| F2 | 6 | 90 | 540 W |
| F13 | 4 | 75 | 300 W |
| F14 | 2 | 86.4 | 172.8 W |

Non-tradable Allowances

| | |
|---------------------------|-----------|
| Illuminated façade length | 403 ft |
| Allowance | 3.75 W/ft |
| Façade power allowance | 1.511 kW |

| Type | Quantity | Watts/Fixture | Type total |
|-------------|-----------------|----------------------|-------------------|
| F12 | 37 | 35 | 1.295 kW |

The façade lighting design meets ASHRAE 90.1 2010's power density requirements for a building façade in zone 3.

Rehearsal Room



Space description

The rehearsal room is a high ceilinged open space, used for both music practice and teaching. Halfway up the wall, it has a technical shelf used to house AV systems, HVAC equipment, and curtain track for the lower walls. The profile of this shelf mirrors the design used repeatedly in the concert hall.

Design Criteria

Illuminance (High Priority)

Music Classroom

- Horizontal (average at 4 ft. AFF)
 - 30 fc
 - Avg:Min = 2:1
- Vertical (average at 4 ft. AFF)
 - 20 fc
 - Avg:Min = 2:1

Uniformity

Without fixed furniture, people can be seated at a chair anywhere in the room. It's important to avoid creating dark spots where music stands can't be read.

Color Temperature

Color temperature should generally be selected to match other sources in an architectural project, avoiding transitions between areas of different CCT. While there are fewer direct reasons to select a warm color temperature here, they would be consistent with the other spaces. On the other hand, some research suggests that higher color temperatures can increase focus and productivity, which could be desired in an office space.

Color Rendition

The tasks performed in these spaces do not require highly accurate color rendition, but consistency with other spaces may be a consideration.

ASHRAE 90.1 2010

Power Allowance (Mandatory)

Classroom

- Lighting Power Density: 1.24 W/ft²
- An additional allowance of up to 1.0 W/ft² is available for decorative lighting

Automatic Shutoff (Mandatory)

An automatic control device is required to control lighting in all spaces. It must be based on either a preset schedule, occupancy sensors, or information from another control system that indicates a space is not occupied.

Display/Accent Lighting (Mandatory)

Display or accent lighting must be controlled separately from general lighting.

Design Overview

As with the lobby, much of the horizontal illuminance here is provided by downlights in high ceiling. Vertical illuminance is essential for reading music on slanted music stands, and must be high in all directions. This is achieved using a linear wallwasher along two sides of the room to bounce light off of the lower walls and curtains, as well as with an asymmetric CFL fixture on the side of the technical shelf. Horizontal illuminance is provided by downlights in the upper ceiling, and asymmetric uplights shine from the top of the technical shelf to illuminate parts of the walls and ceiling.

Figure 18: Rehearsal Room – Balcony Level Lighting Plan

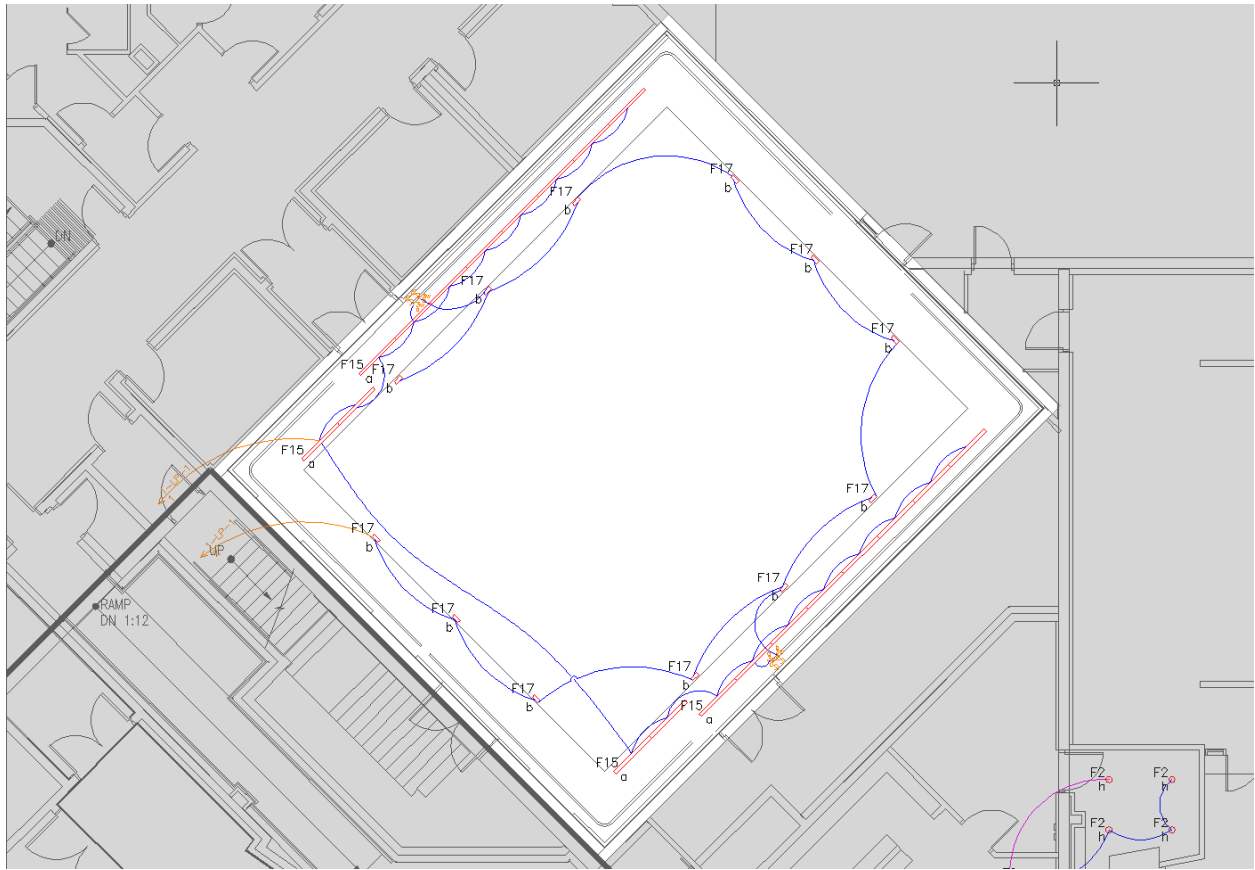
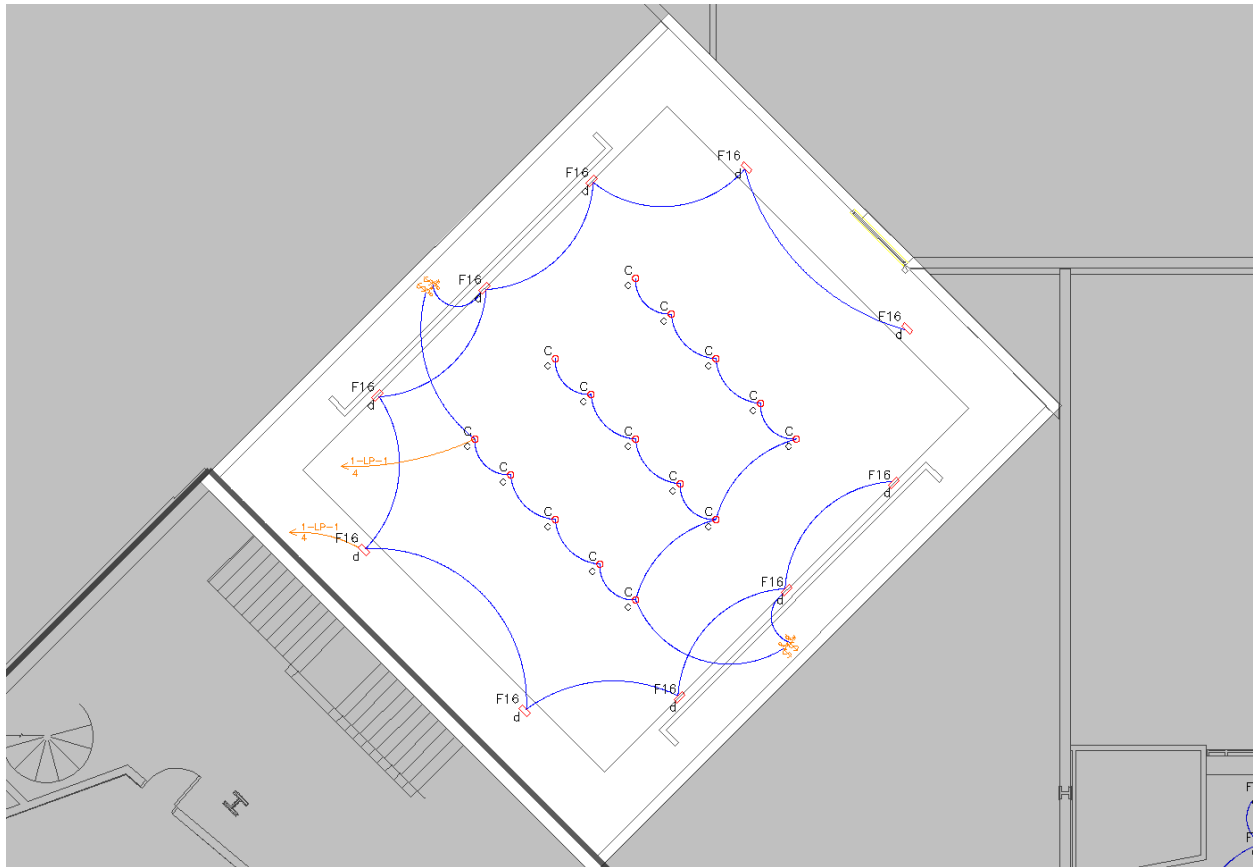


Figure 19: Rehearsal Room – Balcony Level Lighting Plan



Lamp/Luminaire Selection

In keeping with the low energy goals for the project, the space uses fluorescent fixtures. Downlights have wheat reflectors for a warmer feel, and all lamps are 3000K. This is slightly cooler than what was used in the lobby, but the rehearsal room is relatively far removed from the warm red woods of the lobby and concert hall, and 3000K is sufficiently warm for a classroom. The linear wall washers use a standard output T5 lamp.

Fixture Schedule

| Type | Description | Manufacturer | Catalog Number | Lamp(s) | Input Watts |
|------|--|-------------------|---------------------------------|----------------------------|-------------|
| F15 | Recessed linear T5 fixture in 4' lengths with low iridescent louver | Peerless Lighting | LAR9-28T5-LDL-U4-120-C200 | (1) F28W/T5/830/ECO by GE | 26.8 |
| F16 | Adjustable asymmetric CFL wall washer with lockable angle and semi gloss white finish | Winona Lighting | LS8-CFM142-120-P1-SGW-X-STD | (1) F42TBX/830/A/ECO by GE | 43.2 |
| F17 | Semi-recessed asymmetric CFL with semi gloss white finish | Winona Lighting | LSRU-LR-CFM142-120-P1-SGW-X-STD | (1) F42TBX/830/A/ECO by GE | 43.2 |
| F18 | Unlensed 42W compact fluorescent downlight with 6" nominal aperture, white trim, and wheat reflector | Kurt Versen | P927-120-W-WT | (1) F42TBX/830/A/ECO by GE | 43.2 |

Light Loss Factors

Type F15

- $LLD = 2660/2900 = 0.92$
- $LDD = 0.91$ (24 month cleaning cycle, open/unvented)
- $BF = 1.0$
- Total = 0.83

Type F16

- $LLD = 2690/3200 = 0.84$
- $LDD = 0.91$ (24 month cleaning cycle, open/unvented)
- $BF = 1.0$
- Total = 0.76

Type F17

- $LLD = 2690/3200 = 0.84$
- $LDD = 0.91$ (24 month cleaning cycle, open/unvented)
- $BF = 1.0$
- Total = 0.76

Type F18

- $LLD = 2690/3200 = 0.84$
- $LDD = 0.91$ (24 month cleaning cycle, open/unvented)
- $BF = 1.0$
- Total = 0.76

Control System

The four types of lights are set up in four separate switching groups so that they can be used independently and turned off to reduce energy use when they aren't needed.

- a) Linear wall washers
- b) CFL side lights
- c) Upper ceiling downlights
- d) CFL uplights

Controlled by Grafik Eye 4000. See electrical section for details of control system.

Design Performance

Figure 20: Rehearsal Room Rendering

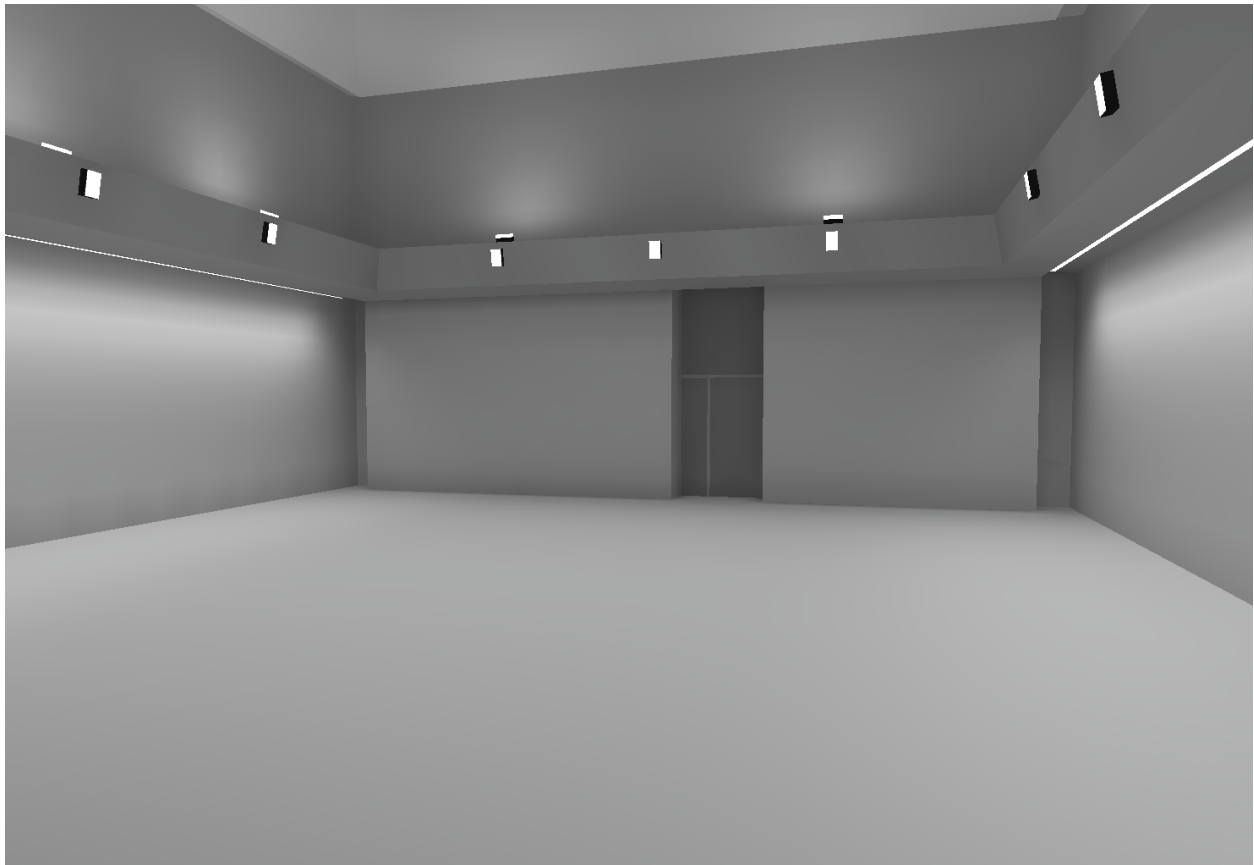
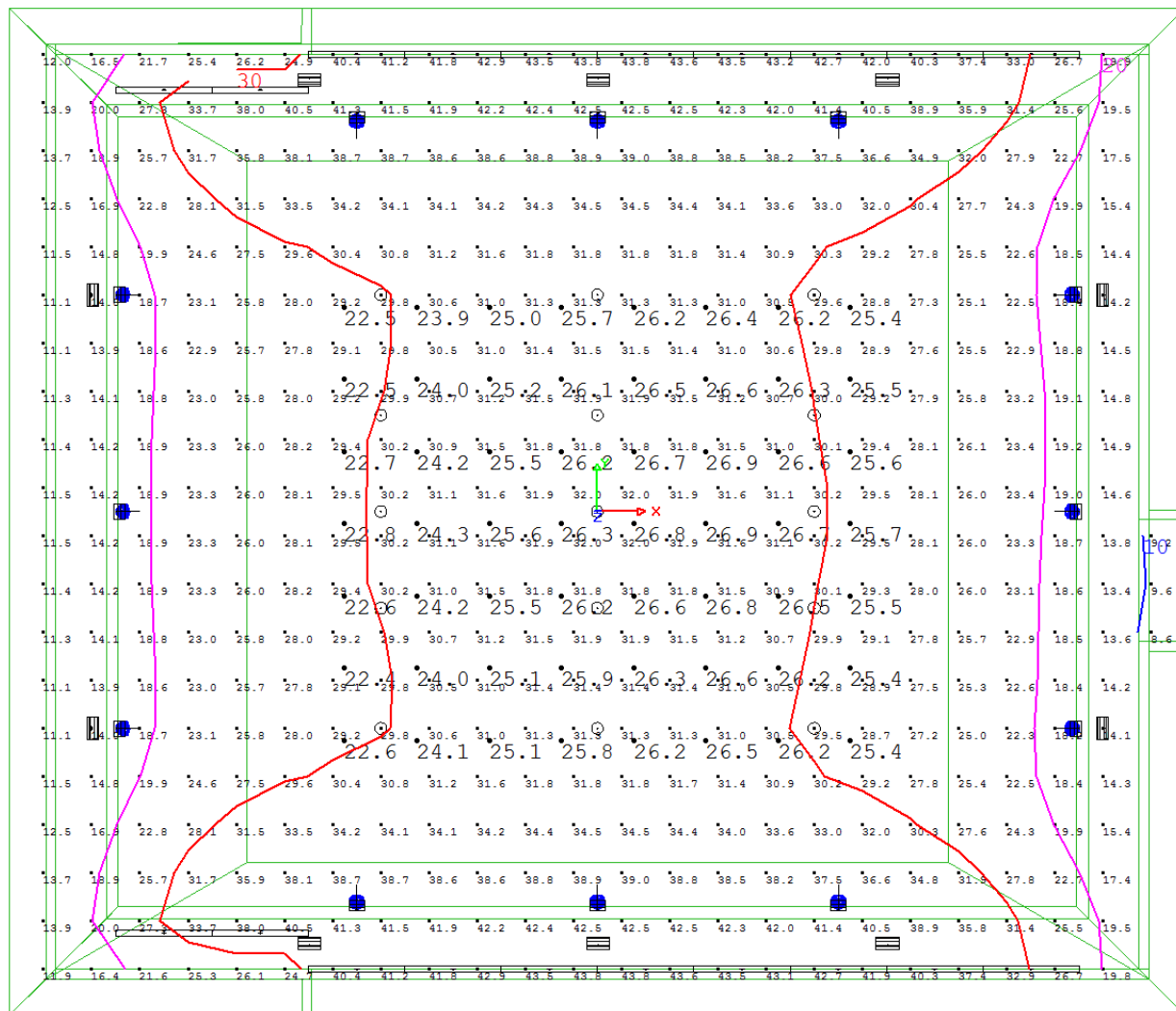


Figure 21: Rehearsal Room Isoilluminance Lines



Red: 30 fc Magenta: 20 fc Blue: 10 fc

The room is brightly illuminated, and meets the target of 30 fc in the center area and toward the sides with linear fixtures. Toward the front and back, it drops off to 20 fc, but only reaches 10 at a few points between the curtain pockets. The average to minimum ratio is 1.13:1, well below the recommended 2:1

Vertical illuminances are also as targeted, with points aimed at 45 degrees (to simulate a music stand) still receiving above 25 fc in the central area.

Lighting Power Density

| | |
|--------------------------|------------------------|
| Area | 2,041 ft ² |
| Max Power Density | 1.24 W/ft ² |
| Lighting power allowance | 2.530 kW |
| Decorative allowance | 2.041 kW |

| Type | Quantity | Watts/Fixture | Type total |
|------|----------|---------------|--------------------|
| F15 | 15 | 26.8 | 402 W |
| F16 | 10 | 43.2 | 432 W (Decorative) |
| F17 | 12 | 43.2 | 518.4 W |
| F18 | 20 | 43.2 | 864 W |

| | |
|----------------------------|----------|
| Total lighting power (kW) | 1.784 kW |
| Space power allowance (kW) | 2.041 kW |
| Total decorative power | 0.432 kW |
| Space decorative allowance | 2.041 kW |

Rehearsal room meets ASHRAE 90.1 2010 power density requirements for a classroom space.

Electrical Redesign

The four redesigned spaces are the main lobby, concert hall, façade, and rehearsal room. Each of these spaces span the first floor and balcony levels. The rehearsal room and lobby are designed to use predominantly CFL sources, while the concert hall uses incandescent downlights with linear LEDs as an efficient architectural accent. The façade's main focus is the upper exterior wall of the concert hall, which is lit by color changing LEDs.

| Panelboards | | | | | | |
|-------------|------------------|--------|----------------|------------|--------------|--------|
| Panel Tag | Voltage | System | Rehearsal Room | Main Lobby | Concert Hall | Façade |
| DR1 | 208Y/120V, 3P 4W | N | | X | X | X |
| DR2 | 208Y/120V, 3P 4W | N | | | X | X |
| EM-XFR-1 | 208Y/120V, 3P 4W | N/E | | X | X | X |
| 1-ELP-1 | 208Y/120V, 3P 4W | N/E | X | | | |
| 1-LL-1 | 208Y/120V, 3P 4W | N | X | | | |

Control Systems

The rehearsal room, as a back of house area, uses a simple switching system, with luminaires grouped by type. There are two entrances on opposite sides of the room, and three way switching is used so that all lighting can be controlled from either one.

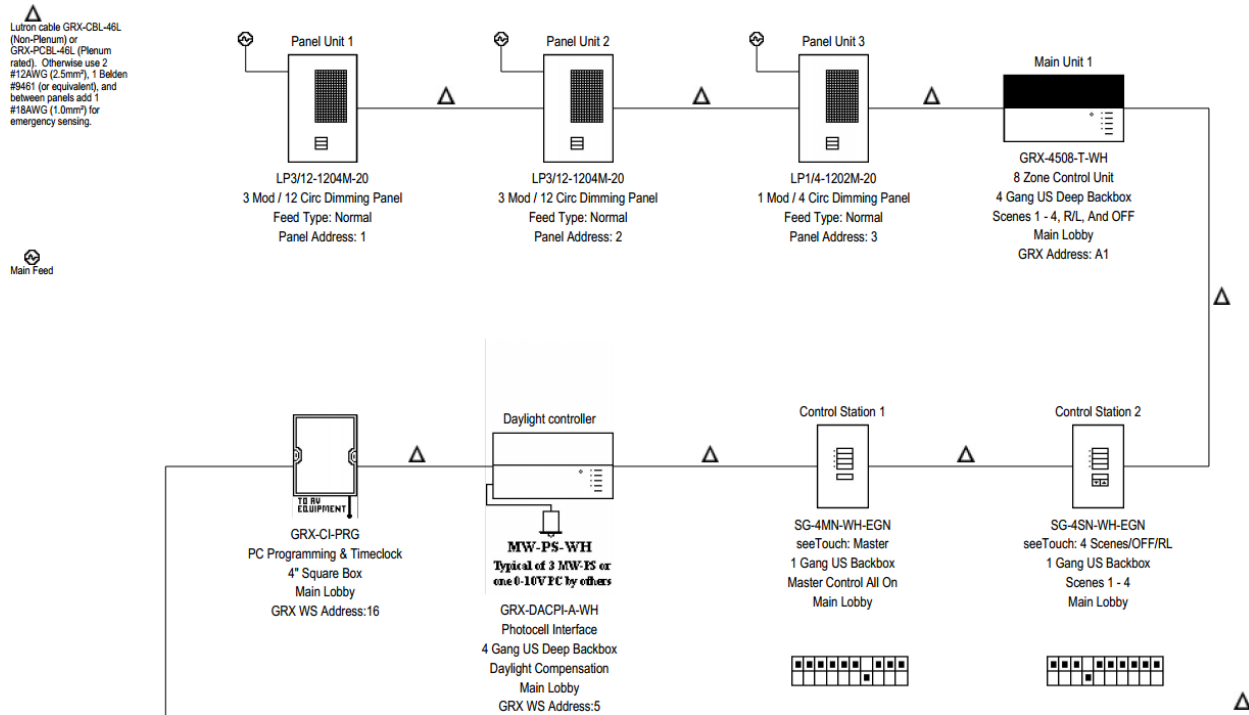
The main lobby, concert hall, and façade are operated by a Lutron Grafik Eye 4000 multi-space dimming system. This product was selected for its ability to control multiple light sources, instead of a standard dimmer rack system for incandescents only, as well as the ability to integrated with a theatrical lighting console. The Grafik Eye 4000 also allows for photosensor controlled dimming (required by ASHRAE 90.1 in the main lobby), and allows emergency lighting to be controlled along with normal lighting circuits using a dimming level override in case of normal power failure.

Table 1: Control Equipment Schedule

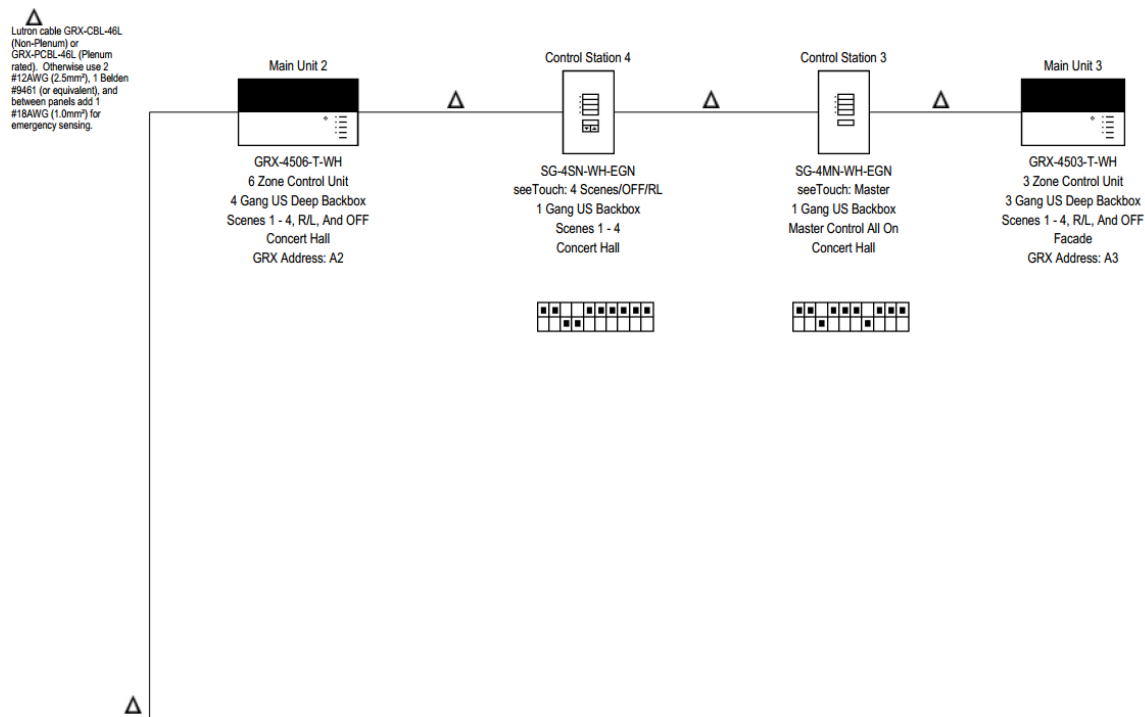
| Grafik 4000 | | | |
|--|-------------------------|--|------------|
| Item | Lutron Model No. | Description | Qty |
| 1) | LP3/12-1204M-20 | 120V Branch Breakers LP Dimming Panel containing 3 20A-1Pole branch breakers rated at 10,000AIC for 3 modules (12 switch legs). 4 dimming outputs per module. Max input feed = 20A (3Ø-4 Wire), 40A (1Ø-3 Wire), 60A (1Ø-2 Wire) | 2 |
| 2) | LP1/4-1202M-20 | 120V Branch Breakers LP Dimming Panel containing 1 20A-1Pole branch breaker rated at 10,000AIC for 1 module (4 switch legs). 4 dimming outputs per module. Max input feed = 20A | 1 |
| 3) | PHPM-3F-120-WH | 120V Fluorescent Power Module. Enables a control to dim Lutron Hi-Lume or Eco-10 Dimming Ballasts. Module requires a neutral wire. Maximum 16A output. 2 Gang US Backbox. | 16 |
| 4) | SG-4SN-WH-EGN | seeTouch series GRAFIK Eye wallstation. Recalls preset light levels for up to 4 scenes plus off. Fine-tuning of light levels with master raise/lower. Noninsert Version; Optional Backlighting. 1 Gang US Backbox. | 2 |
| 5) | SG-4MN-WH-EGN | seeTouch series GRAFIK Eye wallstation. Allows Master Control of any GRAFIK Eye on a button-by button basis. Noninsert Version; Optional Backlighting. 1 Gang US Backbox. | 2 |
| 6) | GRX-DACPI-A-WH | Automatically selects preset scenes on a GRAFIK Eye Control Unit in response to ambient daylight. Opaque Top Cover. Works with either 1 0-10V photocell or up to 3 Lutron MW-PS photocells. 4 Gang US Backbox. | 1 |
| 7) | MW-PS-WH | Ceiling mounted daylight photosensor. Low voltage class 2, 24V DC. | 1 |
| 8) | GRX-CI-PRG | RS232 and Ethernet Interface. Allows for PC Programming with GRX-3500 and GRX-4500 Control Units. Can also be used as an astronomic timeclock for any GRAFIK Eye system. Surface mount. | 1 |
| 9) | GRX-4508-T-WH | 8 Zone GRAFIK Eye 4000 Control Unit with PC Setup Capability and Translucent Top Cover. For use with Lutron GP, LP, and XP Power Panels. 4 Gang US Backbox. | 1 |
| 10) | GRX-4506-T-WH | 6 Zone GRAFIK Eye 4000 Control Unit with PC Setup Capability and Translucent Top Cover. For use with Lutron GP, LP, and XP Power Panels. 4 Gang US Backbox. | 1 |
| 11) | GRX-4503-T-WH | 3 Zone GRAFIK Eye 4000 Control Unit with PC Setup Capability and Translucent Top Cover. For use with Lutron GP, LP, and XP Power Panels. 3 Gang US Backbox. | 1 |
| All electrical devices should match system controls. Use Lutron NovaT* dimmers, switches, receptacles, jacks and faceplates as required. | | | |

Panels are Lutron LP series, which use 20A modules to supply different load types. LED loads are to be dimmed using Lutron Hi-Lume drivers for 1% minimum dimming level, and CFLs below 42W also use Hi-Lume ballasts. Fixtures with 42W triple tube CFLs. These two load types can be served by the same LP dimming module. Each dimming module supports up to 4 dimming zones.

Figure 22: Control System Single-Line



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Existing Panelboards

The drawing set for the project does not include existing branch panelboard schedules. These are estimated based on information from the electrical and lighting design drawings to approximate loads given in the distribution panel schedules.

| PANELBOARD SCHEDULE | | | | | | | | | | | | |
|-----------------------------|-----------|--------------|---|----------|---|------------------------------------|---|----------|--------------------------|--------------|-----------|---------------|
| VOLTAGE: 208Y/120V,3PH,4W | | | PANEL TAG: 1-LP-1 | | | MIN. C/B AIC: 10K | | | | | | |
| SIZE/TYPE BUS: 225A | | | PANEL LOCATION: 173 - Electrical Closet | | | OPTIONS: PROVIDE FEED THROUGH LUGS | | | | | | |
| SIZE/TYPE MAIN: 225A/3P C/B | | | PANEL MOUNTING: SURFACE | | | FOR PANELBOARD 1L1B | | | | | | |
| DESCRIPTION | LOCATION | LOAD (WATTS) | C/B SIZE | POS. NO. | A | B | C | POS. NO. | C/B SIZE | LOAD (WATTS) | LOCATION | DESCRIPTION |
| Lighting | Rehearsal | 1320 | 20A/1P | 1 | * | | | 2 | 20A/1P | 1000 | Rehearsal | Lighting |
| Lighting | Rehearsal | 1000 | 20A/1P | 3 | | * | | 4 | 20A/1P | 915 | Rehearsal | Lighting |
| Existing Load | Misc | 1200 | 20A/1P | 5 | | | * | 6 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 7 | * | | | 8 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 9 | | * | | 10 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 11 | | | * | 12 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 13 | * | | | 14 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 15 | | * | | 16 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 17 | | | * | 18 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 19 | * | | | 20 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 21 | | * | | 22 | 20A/1P | 1200 | Misc | Existing Load |
| | | 0 | 20A/1P | 23 | | | * | 24 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 25 | * | | | 26 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 27 | | | * | 28 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 29 | | | * | 30 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 31 | * | | | 32 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 33 | | * | | 34 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 35 | | | * | 36 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 37 | * | | | 38 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 39 | | * | | 40 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 41 | | | * | 42 | 20A/1P | 0 | | |
| CONNECTED LOAD (KW) - A Ph. | | 9.52 | | | | | | | TOTAL DESIGN LOAD (KW) | | 31.00 | |
| CONNECTED LOAD (KW) - B Ph. | | 9.12 | | | | | | | POWER FACTOR | | 0.91 | |
| CONNECTED LOAD (KW) - C Ph. | | 7.20 | | | | | | | TOTAL DESIGN LOAD (AMPS) | | 95 | |

| PANELBOARD SCHEDULE | | | | | | | | | | | | | |
|-----------------------------|-----------|--------------|---|----------|---|---|---|----------|------------------------------------|--------------|----------|---------------|--|
| VOLTAGE: 208Y/120V,3PH,4W | | | PANEL TAG: 1-ELP-1 | | | | | | MIN. C/B AIC: 10K | | | | |
| SIZE/TYPE BUS: 100A | | | PANEL LOCATION: 173 - Electrical Closet | | | | | | OPTIONS: PROVIDE FEED THROUGH LUGS | | | | |
| SIZE/TYPE MAIN: 15A/3P C/B | | | PANEL MOUNTING: SURFACE | | | | | | FOR PANELBOARD 1L1B | | | | |
| DESCRIPTION | LOCATION | LOAD (WATTS) | C/B SIZE | POS. NO. | A | B | C | POS. NO. | C/B SIZE | LOAD (WATTS) | LOCATION | DESCRIPTION | |
| EM Lighting | Rehearsal | 458 | 20A/1P | 1 | * | | | 2 | 20A/1P | 600 | | Existing Load | |
| Existing Load | | 600 | 20A/1P | 3 | | * | | 4 | 20A/1P | 600 | | Existing Load | |
| Existing Load | | 600 | 20A/1P | 5 | | | * | 6 | 20A/1P | 600 | | Existing Load | |
| Existing Load | | 600 | 20A/1P | 7 | * | | | 8 | 20A/1P | 600 | | Existing Load | |
| Existing Load | | 600 | 20A/1P | 9 | | * | | 10 | 20A/1P | 600 | | Existing Load | |
| Existing Load | | 600 | 20A/1P | 11 | | | * | 12 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 13 | * | | | 14 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 15 | | * | | 16 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 17 | | | * | 18 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 19 | * | | | 20 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 21 | | * | | 22 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 23 | | | * | 24 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 25 | * | | | 26 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 27 | | * | | 28 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 29 | | | * | 30 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 31 | * | | | 32 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 33 | | * | | 34 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 35 | | | * | 36 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 37 | * | | | 38 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 39 | | * | | 40 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 41 | | | * | 42 | 20A/1P | 0 | | | |
| CONNECTED LOAD (KW) - A Ph. | | 2.26 | | | | | | | TOTAL DESIGN LOAD (KW) | | 7.75 | | |
| CONNECTED LOAD (KW) - B Ph. | | 2.40 | | | | | | | POWER FACTOR | | 0.90 | | |
| CONNECTED LOAD (KW) - C Ph. | | 1.80 | | | | | | | TOTAL DESIGN LOAD (AMPS) | | 10 | | |

| PANELBOARD SCHEDULE | | | | | | | | | | | | | |
|-----------------------------|--------------|--------------|-----------------------------------|----------|---|---|---|----------|------------------------------------|--------------|--------------|-----------------------|--|
| VOLTAGE: 208Y/120V,3PH,4W | | | PANEL TAG: DR-1 | | | | | | MIN. C/B AIC: 10K | | | | |
| SIZE/TYPE BUS: 225A | | | PANEL LOCATION: 139 - Dimmer Room | | | | | | OPTIONS: PROVIDE FEED THROUGH LUGS | | | | |
| SIZE/TYPE MAIN: 225A/3P C/B | | | PANEL MOUNTING: SURFACE | | | | | | FOR PANELBOARD 1L1B | | | | |
| DESCRIPTION | LOCATION | LOAD (WATTS) | C/B SIZE | POS. NO. | A | B | C | POS. NO. | C/B SIZE | LOAD (WATTS) | LOCATION | DESCRIPTION | |
| Choral terrace R2 ce | Concert Hall | 1250 | 20A/1P | 1 | * | | | 2 | 20A/1P | 1250 | Concert Hall | Choral terrace R1 cen | |
| Choral terrace SL | Concert Hall | 1500 | 20A/1P | 3 | | * | | 4 | 20A/1P | 1500 | Concert Hall | Choral terrace SR | |
| Row 1 HR | Concert Hall | 1725 | 20A/1P | 5 | | | * | 6 | 20A/1P | 1725 | Concert Hall | Row 1 center | |
| Row 2 HR | Concert Hall | 1725 | 20A/1P | 7 | * | | | 8 | 20A/1P | 1725 | Concert Hall | Row 2 CR | |
| Row 2 CL | Concert Hall | 1725 | 20A/1P | 9 | | * | | 10 | 20A/1P | 1725 | Concert Hall | Row 2 HL | |
| Row 3 HR | Concert Hall | 1725 | 20A/1P | 11 | | | * | 12 | 20A/1P | 1725 | Concert Hall | Row 3 CR | |
| Row 3 CL | Concert Hall | 1725 | 20A/1P | 13 | * | | | 14 | 20A/1P | 1725 | Concert Hall | Row 3 HL | |
| Row 4 HR | Concert Hall | 1725 | 20A/1P | 15 | | * | | 16 | 20A/1P | 1725 | Concert Hall | Row 4 CR | |
| Row 5 HR | Concert Hall | 1725 | 20A/1P | 17 | | | * | 18 | 20A/1P | 1725 | Concert Hall | Row 5 CR | |
| Row 5 C | Concert Hall | 1725 | 20A/1P | 19 | * | | | 20 | 20A/1P | 1725 | Concert Hall | Row 5 CL | |
| Row 5 HL | Concert Hall | 1725 | 20A/1P | 21 | | * | | 22 | 20A/1P | 1725 | Concert Hall | Catwalk #4 HR | |
| Catwalk #4 CR | Concert Hall | 1725 | 20A/1P | 23 | | | * | 24 | 20A/1P | 1725 | Concert Hall | Catwalk #4 CL | |
| Catwalk #4 HL | Concert Hall | 1725 | 20A/1P | 25 | * | | | 26 | 20A/1P | 308 | Main Lobby | Column backlight | |
| Seating sconces | Main Lobby | 46 | 20A/1P | 27 | | * | | 28 | 20A/1P | 300 | Main Lobby | Column light | |
| Column light | Main Lobby | 300 | 20A/1P | 29 | | | * | 30 | 20A/1P | 300 | Main Lobby | Column light | |
| Column light | Main Lobby | 300 | 20A/1P | 31 | * | | | 32 | 20A/1P | 1575 | Main Lobby | Wood washers | |
| Bridge downlights | Main Lobby | 1500 | 20A/1P | 33 | | * | | 34 | 20A/1P | 1500 | Main Lobby | Coat check | |
| Coat check | Main Lobby | 700 | 20A/1P | 35 | | | * | 36 | 20A/1P | 600 | Main Lobby | Main entrance | |
| Concert entry | Main Lobby | 200 | 20A/1P | 37 | * | | | 38 | 20A/1P | 1125 | Main Lobby | Upper wall wash | |
| North lobby track | Main Lobby | 1100 | 20A/1P | 39 | | * | | 40 | 20A/1P | 1400 | Main Lobby | North lobby accent | |
| Ceiling uplight | Main Lobby | 1500 | 20A/1P | 41 | | | * | 42 | 20A/1P | 1500 | Main Lobby | Ceiling uplight | |
| CONNECTED LOAD (KW) - A Ph. | | 18.08 | | | | | | | TOTAL DESIGN LOAD (KW) | | 67.18 | | |
| CONNECTED LOAD (KW) - B Ph. | | 19.20 | | | | | | | POWER FACTOR | | 1.00 | | |
| CONNECTED LOAD (KW) - C Ph. | | 18.70 | | | | | | | TOTAL DESIGN LOAD (AMPS) | | 187 | | |

| PANELBOARD SCHEDULE | | | | | | | | | | | | |
|-----------------------------|--------------|--------------|-----------------------------------|----------|---|---|---|----------|------------------------------------|--------------|--------------|----------------------------|
| VOLTAGE: 208Y/120V,3PH,4W | | | PANEL TAG: DR-2 | | | | | | MIN. C/B AIC: 10K | | | |
| SIZE/TYPE BUS: 225A | | | PANEL LOCATION: 139 - Dimmer Room | | | | | | OPTIONS: PROVIDE FEED THROUGH LUGS | | | |
| SIZE/TYPE MAIN: 225A/3P C/B | | | PANEL MOUNTING: SURFACE | | | | | | FOR PANELBOARD 1L1B | | | |
| DESCRIPTION | LOCATION | LOAD (WATTS) | C/B SIZE | POS. NO. | A | B | C | POS. NO. | C/B SIZE | LOAD (WATTS) | LOCATION | DESCRIPTION |
| Entry vestibules | Lobby | 1000 | 20A/1P | 1 | * | | | 2 | 20A/1P | 1000 | Concert Hall | Downlights - Row 1 out |
| Downlights - Row 1 in | Concert Hall | 1250 | 20A/1P | 3 | | * | | 4 | 20A/1P | 1000 | Concert Hall | Downlights - Row 2 out |
| Downlights - Row 2 in | Concert Hall | 1250 | 20A/1P | 5 | | | * | 6 | 20A/1P | 400 | Concert Hall | Downlights - Row 3 out |
| Downlights - Row 3 in | Concert Hall | 500 | 20A/1P | 7 | * | | | 8 | 20A/1P | 1200 | Concert Hall | Downlights - Under balcony |
| Downlights - Under balcony | Concert Hall | 200 | 20A/1P | 9 | | * | | 10 | 20A/1P | 600 | Concert Hall | Rear wallwashers |
| House rear wall | Concert Hall | 1080 | 20A/1P | 11 | | | * | 12 | 20A/1P | 1080 | Concert Hall | House rear wall |
| House side wall | Concert Hall | 1320 | 20A/1P | 13 | * | | | 14 | 20A/1P | 1320 | Concert Hall | House side wall |
| Platform lower wall | Concert Hall | 980 | 20A/1P | 15 | | * | | 16 | 20A/1P | 980 | Concert Hall | Platform lower wall |
| Platform rear lower wall | Concert Hall | 1400 | 20A/1P | 17 | | | * | 18 | 20A/1P | 720 | Concert Hall | Platform center lower wall |
| Balcony rear wall wash | Concert Hall | 1900 | 20A/1P | 19 | * | | | 20 | 20A/1P | 1440 | Concert Hall | Balcony side wall |
| Balcony side wall | Concert Hall | 1440 | 20A/1P | 21 | | * | | 22 | 20A/1P | 1440 | Concert Hall | Choir terrace sidewall |
| Choir terrace sidewall | Concert Hall | 1440 | 20A/1P | 23 | | | * | 24 | 20A/1P | 1200 | Concert Hall | Choir terrace rear wall |
| Choir terrace rear wall | Concert Hall | 1080 | 20A/1P | 25 | * | | | 26 | 20A/1P | 2400 | Concert Hall | Upper sidewall |
| Upper sidewall | Concert Hall | 2400 | 20A/1P | 27 | | * | | 28 | 20A/1P | 1080 | Concert Hall | Upper rear wall |
| Balcony rail sconces | Concert Hall | 400 | 20A/1P | 29 | | | * | 30 | 20A/1P | 480 | Concert Hall | Balcony rail sconces |
| Balcony rail sconces | Concert Hall | 600 | 20A/1P | 31 | * | | | 32 | 20A/1P | 0 | Main Lobby | Signage spot |
| Signage spot | Main Lobby | 0 | 20A/1P | 33 | | * | | 34 | 20A/1P | 0 | Main Lobby | Main lobby track |
| Main lobby track | Main Lobby | 0 | 20A/1P | 35 | | | * | 36 | 20A/1P | 0 | Main Lobby | Main lobby track |
| | | 0 | 20A/1P | 37 | * | | | 38 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 39 | | * | | 40 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 41 | | | * | 42 | 20A/1P | 0 | | |
| CONNECTED LOAD (KW) - A Ph. | | 13.76 | | | | | | | TOTAL DESIGN LOAD (KW) | | 41.50 | |
| CONNECTED LOAD (KW) - B Ph. | | 11.37 | | | | | | | POWER FACTOR | | 1.00 | |
| CONNECTED LOAD (KW) - C Ph. | | 9.45 | | | | | | | TOTAL DESIGN LOAD (AMPS) | | 115 | |

Revised Panelboards

| PANELBOARD SCHEDULE | | | | | | | | | | | | |
|-----------------------------|----------------|--------------|---|----------|---|---|---|----------|------------------------------------|--------------|----------------|--------------------|
| VOLTAGE: 208Y/120V,3PH,4W | | | PANEL TAG: 1-LP-1 | | | | | | MIN. C/B AIC: 10K | | | |
| SIZE/TYPE BUS: 225A | | | PANEL LOCATION: 173 - Electrical Closet | | | | | | OPTIONS: PROVIDE FEED THROUGH LUGS | | | |
| SIZE/TYPE MAIN: 225A/3P C/B | | | PANEL MOUNTING: SURFACE | | | | | | FOR PANELBOARD 1L1B | | | |
| DESCRIPTION | LOCATION | LOAD (WATTS) | C/B SIZE | POS. NO. | A | B | C | POS. NO. | C/B SIZE | LOAD (WATTS) | LOCATION | DESCRIPTION |
| Rehearsal lighting | Rehearsal Room | 921 | 20A/1P | 1 | * | | | 2 | 20A/1P | 950 | Rehearsal Room | Rehearsal lighting |
| Existing Load | Misc | 1200 | 20A/1P | 3 | | * | | 4 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 5 | | | * | 6 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 7 | * | | | 8 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 9 | | * | | 10 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 11 | | | * | 12 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 13 | * | | | 14 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 15 | | * | | 16 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 17 | | | * | 18 | 20A/1P | 1200 | Misc | Existing Load |
| Existing Load | Misc | 1200 | 20A/1P | 19 | * | | | 20 | 20A/1P | 1200 | Misc | Existing Load |
| | | 0 | 20A/1P | 21 | | * | | 22 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 23 | | | * | 24 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 25 | * | | | 26 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 27 | | * | | 28 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 29 | | | * | 30 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 31 | * | | | 32 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 33 | | * | | 34 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 35 | | | * | 36 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 37 | * | | | 38 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 39 | | * | | 40 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 41 | | | * | 42 | 20A/1P | 0 | | |
| CONNECTED LOAD (KW) - A Ph. | | 9.07 | | | | | | | TOTAL DESIGN LOAD (KW) | | 28.17 | |
| CONNECTED LOAD (KW) - B Ph. | | 7.20 | | | | | | | POWER FACTOR | | 0.90 | |
| CONNECTED LOAD (KW) - C Ph. | | 7.20 | | | | | | | TOTAL DESIGN LOAD (AMPS) | | 87 | |

| PANELBOARD SCHEDULE | | | | | | | | | | | | | |
|-----------------------------|----------------|--------------|---|----------|---|---|---|----------|------------------------------------|--------------|--------------|---------------|--|
| VOLTAGE: 208Y/120V,3PH,4W | | | PANEL TAG: 1-ELP-1 | | | | | | MIN. C/B AIC: 10K | | | | |
| SIZE/TYPE BUS: 100A | | | PANEL LOCATION: 173 - Electrical Closet | | | | | | OPTIONS: PROVIDE FEED THROUGH LUGS | | | | |
| SIZE/TYPE MAIN: 100A/3P C/B | | | PANEL MOUNTING: SURFACE | | | | | | FOR PANELBOARD 1L1B | | | | |
| DESCRIPTION | LOCATION | LOAD (WATTS) | C/B SIZE | POS. NO. | A | B | C | POS. NO. | C/B SIZE | LOAD (WATTS) | LOCATION | DESCRIPTION | |
| EM Lighting | Rehearsal room | 130 | 20A/1P | 1 | * | | | 2 | 20A/1P | 600 | Misc | Existing Load | |
| Existing Load | Misc | 600 | 20A/1P | 3 | | * | | 4 | 20A/1P | 600 | Misc | Existing Load | |
| Existing Load | Misc | 600 | 20A/1P | 5 | | | * | 6 | 20A/1P | 600 | Misc | Existing Load | |
| Existing Load | Misc | 600 | 20A/1P | 7 | * | | | 8 | 20A/1P | 600 | Misc | Existing Load | |
| Existing Load | Misc | 600 | 20A/1P | 9 | | * | | 10 | 20A/1P | 600 | Misc | Existing Load | |
| Existing Load | Misc | 600 | 20A/1P | 11 | | | * | 12 | 20A/1P | 525 | Concert Hall | EM Lighting | |
| EM Lighting | Concert Hall | 176 | 20A/1P | 13 | * | | | 14 | 20A/1P | 1270 | Concert Hall | EM Lighting | |
| EM Lighting | Main Lobby | 333 | 20A/1P | 15 | | * | | 16 | 20A/1P | 712 | Main Lobby | EM Lighting | |
| | | 0 | 20A/1P | 17 | | | * | 18 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 19 | * | | | 20 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 21 | | * | | 22 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 23 | | | * | 24 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 25 | * | | | 26 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 27 | | * | | 28 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 29 | | | * | 30 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 31 | * | | | 32 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 33 | | * | | 34 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 35 | | | * | 36 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 37 | * | | | 38 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 39 | | * | | 40 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 41 | | | * | 42 | 20A/1P | 0 | | | |
| CONNECTED LOAD (KW) - A Ph. | | 3.38 | | | | | | | TOTAL DESIGN LOAD (KW) | | 10.97 | | |
| CONNECTED LOAD (KW) - B Ph. | | 3.45 | | | | | | | POWER FACTOR | | 0.90 | | |
| CONNECTED LOAD (KW) - C Ph. | | 2.33 | | | | | | | TOTAL DESIGN LOAD (AMPS) | | 34 | | |

| PANELBOARD SCHEDULE | | | | | | | | | | | | | |
|-----------------------------|--------------|--------------|-----------------------------------|----------|---|---|---|----------|------------------------------------|--------------|--------------|-----------------------|--|
| VOLTAGE: 208Y/120V,3PH,4W | | | PANEL TAG: DR-1 | | | | | | MIN. C/B AIC: 10K | | | | |
| SIZE/TYPE BUS: 225A | | | PANEL LOCATION: 139 - Dimmer Room | | | | | | OPTIONS: PROVIDE FEED THROUGH LUGS | | | | |
| SIZE/TYPE MAIN: 225A/3P C/B | | | PANEL MOUNTING: SURFACE | | | | | | FOR PANELBOARD 1L1B | | | | |
| DESCRIPTION | LOCATION | LOAD (WATTS) | C/B SIZE | POS. NO. | A | B | C | POS. NO. | C/B SIZE | LOAD (WATTS) | LOCATION | DESCRIPTION | |
| Choral terrace R2 ce | Concert Hall | 1250 | 20A/1P | 1 | * | | | 2 | 20A/1P | 1250 | Concert Hall | Choral terrace R1 cen | |
| Choral terrace SL | Concert Hall | 1500 | 20A/1P | 3 | | * | | 4 | 20A/1P | 1500 | Concert Hall | Choral terrace SR | |
| Row 1 HR | Concert Hall | 1725 | 20A/1P | 5 | | | * | 6 | 20A/1P | 1725 | Concert Hall | Row 1 center | |
| Row 2 HR | Concert Hall | 1725 | 20A/1P | 7 | * | | | 8 | 20A/1P | 1725 | Concert Hall | Row 2 CR | |
| Row 2 CL | Concert Hall | 1725 | 20A/1P | 9 | | * | | 10 | 20A/1P | 1725 | Concert Hall | Row 2 HL | |
| Row 3 HR | Concert Hall | 1725 | 20A/1P | 11 | | | * | 12 | 20A/1P | 1725 | Concert Hall | Row 3 CR | |
| Row 3 CL | Concert Hall | 1725 | 20A/1P | 13 | * | | | 14 | 20A/1P | 1725 | Concert Hall | Row 3 HL | |
| Row 4 HR | Concert Hall | 1725 | 20A/1P | 15 | | * | | 16 | 20A/1P | 1725 | Concert Hall | Row 4 CR | |
| Row 5 HR | Concert Hall | 1725 | 20A/1P | 17 | | | * | 18 | 20A/1P | 1725 | Concert Hall | Row 5 CR | |
| Row 5 C | Concert Hall | 1725 | 20A/1P | 19 | * | | | 20 | 20A/1P | 1725 | Concert Hall | Row 5 CL | |
| Row 5 HL | Concert Hall | 1725 | 20A/1P | 21 | | * | | 22 | 20A/1P | 1725 | Concert Hall | Catwalk #4 HR | |
| Catwalk #4 CR | Concert Hall | 1725 | 20A/1P | 23 | | | * | 24 | 20A/1P | 1725 | Concert Hall | Catwalk #4 CL | |
| Catwalk #4 HL | Concert Hall | 1725 | 20A/1P | 25 | * | | | 26 | 20A/1P | 1359 | Lobby | 1st floor lighting | |
| Main downlights | Lobby | 1685 | 20A/1P | 27 | | * | | 28 | 20A/1P | 1296 | Lobby | North lighting | |
| South lighting | Lobby | 732 | 20A/1P | 29 | | | * | 30 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 31 | * | | | 32 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 33 | | * | | 34 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 35 | | | * | 36 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 37 | * | | | 38 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 39 | | * | | 40 | 20A/1P | 0 | | | |
| | | 0 | 20A/1P | 41 | | | * | 42 | 20A/1P | 0 | | | |
| CONNECTED LOAD (KW) - A Ph. | | 15.93 | | | | | | | TOTAL DESIGN LOAD (KW) | | 56.16 | | |
| CONNECTED LOAD (KW) - B Ph. | | 16.33 | | | | | | | POWER FACTOR | | 0.99 | | |
| CONNECTED LOAD (KW) - C Ph. | | 14.53 | | | | | | | TOTAL DESIGN LOAD (AMPS) | | 158 | | |

| PANELBOARD SCHEDULE | | | | | | | | | | | | |
|-----------------------------|--------------|--------------|-----------------------------------|----------|---|---|---|----------|------------------------------------|--------------|--------------|----------------------------|
| VOLTAGE: 208Y/120V,3PH,4W | | | PANEL TAG: DR-2 | | | | | | MIN. C/B AIC: 10K | | | |
| SIZE/TYPE BUS: 225A | | | PANEL LOCATION: 139 - Dimmer Room | | | | | | OPTIONS: PROVIDE FEED THROUGH LUGS | | | |
| SIZE/TYPE MAIN: 225A/3P C/B | | | PANEL MOUNTING: SURFACE | | | | | | FOR PANELBOARD 1L1B | | | |
| DESCRIPTION | LOCATION | LOAD (WATTS) | C/B SIZE | POS. NO. | A | B | C | POS. NO. | C/B SIZE | LOAD (WATTS) | LOCATION | DESCRIPTION |
| Entry vestibules | Lobby | 1000 | 20A/1P | 1 | * | | | 2 | 20A/1P | 600 | Concert Hall | Rear wallwashers |
| Platform lower wall | Concert Hall | 980 | 20A/1P | 3 | | * | | 4 | 20A/1P | 980 | Concert Hall | Platform lower wall |
| Platform rear lower wall | Concert Hall | 1400 | 20A/1P | 5 | | | * | 6 | 20A/1P | 720 | Concert Hall | Platform center lower wall |
| Chour terrace sidewall | Concert Hall | 1440 | 20A/1P | 7 | * | | | 8 | 20A/1P | 1440 | Concert Hall | Chour terrace sidewall |
| Chour terrace rear wall | Concert Hall | 1200 | 20A/1P | 9 | | * | | 10 | 20A/1P | 1080 | Concert Hall | Chour terrace rear ctr |
| Upper sidewall | Concert Hall | 2400 | 20A/1P | 11 | | | * | 12 | 20A/1P | 2400 | Concert Hall | Upper sidewall |
| Upper rear wall | Concert Hall | 1080 | 20A/1P | 13 | * | | | 14 | 20A/1P | 1200 | Concert Hall | First floor downlights |
| Upper downlights 1 | Concert Hall | 1250 | 20A/1P | 15 | | * | | 16 | 20A/1P | 1250 | Concert Hall | Upper downlights 2 |
| Upper downlights 3 | Concert Hall | 450 | 20A/1P | 17 | | | * | 18 | 20A/1P | 1600 | Concert Hall | Wide LED strips 1 |
| Wide LED strips 2 | Concert Hall | 1600 | 20A/1P | 19 | * | | | 20 | 20A/1P | 949 | Concert Hall | Narrow LED strips |
| Façade lighting | Façade | 1644 | 20A/1P | 21 | | * | | 22 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 23 | | | * | 24 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 25 | * | | | 26 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 27 | | * | | 28 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 29 | | | * | 30 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 31 | * | | | 32 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 33 | | * | | 34 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 35 | | | * | 36 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 37 | * | | | 38 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 39 | | * | | 40 | 20A/1P | 0 | | |
| | | 0 | 20A/1P | 41 | | | * | 42 | 20A/1P | 0 | | |
| CONNECTED LOAD (KW) - A Ph. | | 9.31 | | | | | | | TOTAL DESIGN LOAD (KW) | | 32.00 | |
| CONNECTED LOAD (KW) - B Ph. | | 8.38 | | | | | | | POWER FACTOR | | 0.98 | |
| CONNECTED LOAD (KW) - C Ph. | | 8.97 | | | | | | | TOTAL DESIGN LOAD (AMPS) | | 91 | |

Protective Device Coordination

Short Circuit Analysis

Transformer Consolidation □ Electrical Depth

1

As designed, the Wentz Concert Hall and Fine Arts Center has five transformers to serve its 120/208V systems. How many of these could be consolidated into a single transformer, and what would the effect of fewer but larger transformers on the overall cost of the electrical system?

One of the transformers, TLL-LDP-1, serves the kitchen and miscellaneous lighting and power loads throughout the building. Others are dedicated to more specific purposes: T1-TLDP-1 serves the concert hall, T1-TLDP-2 serves the black box theater, T1-DCTP-1 is a power conditioner for the audiovisual system, and TLL-ELP-1 receives power from an emergency transfer switch to serve most of the emergency loads.

These transformers can't all be consolidated to a central device; the clean technical power needs to remain on an isolated system with its own power conditioner. The other four can be, provided that the generator and fire pump are switched to 208/120V so that the emergency panel no longer needs a transformer.

The central transformer will be located in the main electrical room on the lower level (LL49), where TLL-LDP-1 is currently sited. To accommodate a larger transformer, the wall shared with the emergency electrical room (LL50) can be moved several feet, which no longer needs space for TLL-ELP-1.

Several changes must be made to accommodate the proposed system. Feeders directly to the 208/120V panelboards are sized up from what originally served the transformers. The generator, firepump, and emergency transfer switches are replaced to operate at 208/120V. And, of course, four of the transformers are replaced by a single large unit. The new transformer will be fed directly from the main switchboard.

Cost estimates used are total prices including materials, labor, overhead, and profit, and are based on data from Q1 2012.

Panelboards

The distribution panel LL-HDP-1 serves, T1-DCTP-1, LL-ELP-1 (via ATS-1), and TLL-LDP-1. The second and third of these transformers will be removed, and LL-HDP-1 can be removed (and replaced with a 208/120 V panel), as it would now only be serving the clean technical power transformer.

The new transformer will require a panel (located in the space left by LL-HDP-1), to distribute power to the panels originally served by their own transformers. This panel, LL-LDP, will include the following loads:

| Panel | Demand Load (KVA) |
|--------------|-------------------|
| 1-TLDP-1 | 116.2 |
| 1-TLDP-2 | 100.3 |
| LL-ELP-1 | 38 |
| LL-LDP-1 | 206.9 |
| Total | 461.4 |

This gives a demand ampacity of 3841A, which can't be met with a 4000A bus switchboard.

Table 2: Original Distribution Panel Costs

| Tag | Original Design | |
|--------------|-----------------|---------------------|
| | Panel Size | Cost |
| 1-TLDP-1 | 800 A | \$ 4,375.00 |
| 1-TLDP-2 | 1400 A | \$ 5,625.00 |
| LL-ELP-1 | 400 A | \$ 2,860.00 |
| LL-LDP-1 | 1200 A | \$ 5,275.00 |
| Total | | \$ 18,135.00 |

Table 3: Redesigned Distribution Panel Costs

| Tag | Proposed Centralized Design | |
|--------|-----------------------------|----------|
| | Panel Size | Cost |
| LL-LDP | 4000 A | \$12,200 |

Transformer

The new transformer, TLL-LDP is sized at 500 kVA to supply the LL-LDP panelboard described above.

It replaces T1-TLDP-1, T1-TLDP-2, TLL-ELP-1, and TLL-LDP-1.

Table 4: Original Transformer Costs

| Tag | Original Design | |
|----------|------------------|-------------|
| | Transformer Size | Cost |
| 1-TLDP-1 | 225 kVA | \$8,624 |
| 1-TLDP-2 | 225 kVA | \$8,624 |
| LL-ELP-1 | 30 kVA | \$2,800 |
| LL-LDP-1 | 300 kVA | \$10,690.00 |
| Total | | \$30,738.00 |

Table 5: Redesigned Transformer Costs

| Tag | Proposed Centralized Design | |
|---------|-----------------------------|----------|
| | Transformer Size | Cost |
| TLL-LDP | 500 kVA | \$16,325 |

Feeders

One effect of a centralized transformer is that larger wires are required to distribute power out to the 208/120V panelboards, increasing wiring cost.

Table 6: Original Feeder Costs

| Load | Type | Phase/N | Ground | Original Design | | | | Total cost |
|-----------|------|------------|--------|---------------------|------------------|-------------------|-------|--------------|
| | | | | Raceway Length (ft) | Feeder cost / ft | Raceway cost / ft | | |
| T1-TLDP-1 | THHN | (3) 350 | 3 | 2 1/2" | 135 | 16.705 | 28.5 | \$ 6,102.68 |
| T1-TLDP-2 | THHN | (3) 350 | 3 | 2 1/2" | 165 | 15.03 | 28.5 | \$ 7,182.45 |
| LL-ELP-2 | THHN | (3) 8 | 10 | 3/4" | 15 | 4.28 | 10.25 | \$ 217.95 |
| LL-LDP-1 | THHN | (3) 500 | 3 | 3" | 30 | 20.72 | 36.2 | \$ 1,707.60 |
| FPC-ATS | THHN | (4) 1 | n/a | 1 1/4" | 25 | 8.48 | 14.85 | \$ 583.25 |
| LL-HDP-1 | THHN | 2x (4) 500 | 1/0 | 3 1/2" | 15 | 50.8 | 44.9 | \$ 1,435.50 |
| T1-DCTP-1 | THHN | (3) 1 | 8 | 1 1/4" | 155 | 7.515 | 14.85 | \$ 3,466.58 |
| Total: | | | | | | | | \$ 20,696.00 |

Table 7: Redesigned Feeder Costs

| Load | Proposed Centralized Design | | | | | | | Feeder cost / ft | Raceway cost / ft | Total cost |
|-----------|-----------------------------|----------|------|------------|--------|---------------------|-----|------------------|-------------------|-------------|
| | Design KVA | Design A | Type | Phase/N | Ground | Raceway Length (ft) | | | | |
| 1-TLDP-1 | 133 | 369 | THHN | (4) 400 | 3 | 3" | 135 | 24.235 | 36.2 | \$ 8,158.73 |
| 1-TLDP-2 | 146 | 405 | THHN | (4) 500 | 2 | 3" | 165 | 27.075 | 36.2 | \$10,440.38 |
| LL-ELP-1 | 30 | 83 | THHN | (4) 5 | 8 | 1" | 15 | 9.7 | 12.21 | \$ 328.65 |
| LL-LDP-1 | 244 | 677 | THHN | 2x (4) 350 | 2x 3 | 3 1/2" | 30 | 43.43 | 44.9 | \$ 2,649.90 |
| FPC-ATS | 80 | 222 | THHN | (4) 3/0 | 4 | 2" | 25 | 14.13 | 20.15 | \$ 857.00 |
| LL-LDP | 462 | 1282 | THHN | 3x (4) 500 | 3 | (3) 2 1/2" | 15 | 81.225 | 85.5 | \$ 2,500.88 |
| T1-DCTP-1 | 75 | 90 | THHN | (3) 1 | 8 | 1 1/4" | 165 | 7.515 | 14.85 | \$ 3,690.23 |
| Total: | | | | | | | | | | \$28,625.75 |

Overall cost

Table 8: Original and Redesign Cost Comparison

| Category | Original Cost (\$) | Centralized Cost (\$) |
|--------------|---------------------|-----------------------|
| Panels | \$ 18,135.00 | \$ 12,200.00 |
| Transformers | \$ 30,738.00 | \$ 16,325.00 |
| Feeders | \$ 20,696.00 | \$ 28,625.75 |
| Total | \$ 69,569.00 | \$ 57,150.75 |

As you can see, the cost of the distribution panels and feeders is somewhat lower for a centralized panelboard. But this comes with the cost of slower installation and the possibility of needing to oversize feeders or branch circuits to reduce voltage drop. Additionally, centralizing the transformers introduces a single point of failure to the system. If the transformer has a defect, it would cut off power to the entire 120/208V system.

Photovoltaic Array □ Electrical Depth 2

With the escalating cost of energy, photovoltaic power generation has become more and more popular. In this depth, I'll propose the addition of a solar system on the Wentz Concert Hall's upper roof.

Equipment

Panel

The system uses a crystalline silicon SunPower SPR-210-BLK solar panel, with an overall efficiency of 16.89%. It produces a maximum power of 210.1 W_{DC} at 40 V_{DC} and 5.25 A_{DC}. The open circuit voltage is 47.7 V_{DC} per panel, and short circuit current is 5.75 A_{DC}. Each module is composed of 72 cells connected in series.

The panels are 61.4 inches long, 31.4 inches wide, and 1.8 inch thick. They each weigh 33 lbs. Panels are estimated to cost \$2.05 per W_{DC}.

Inverter

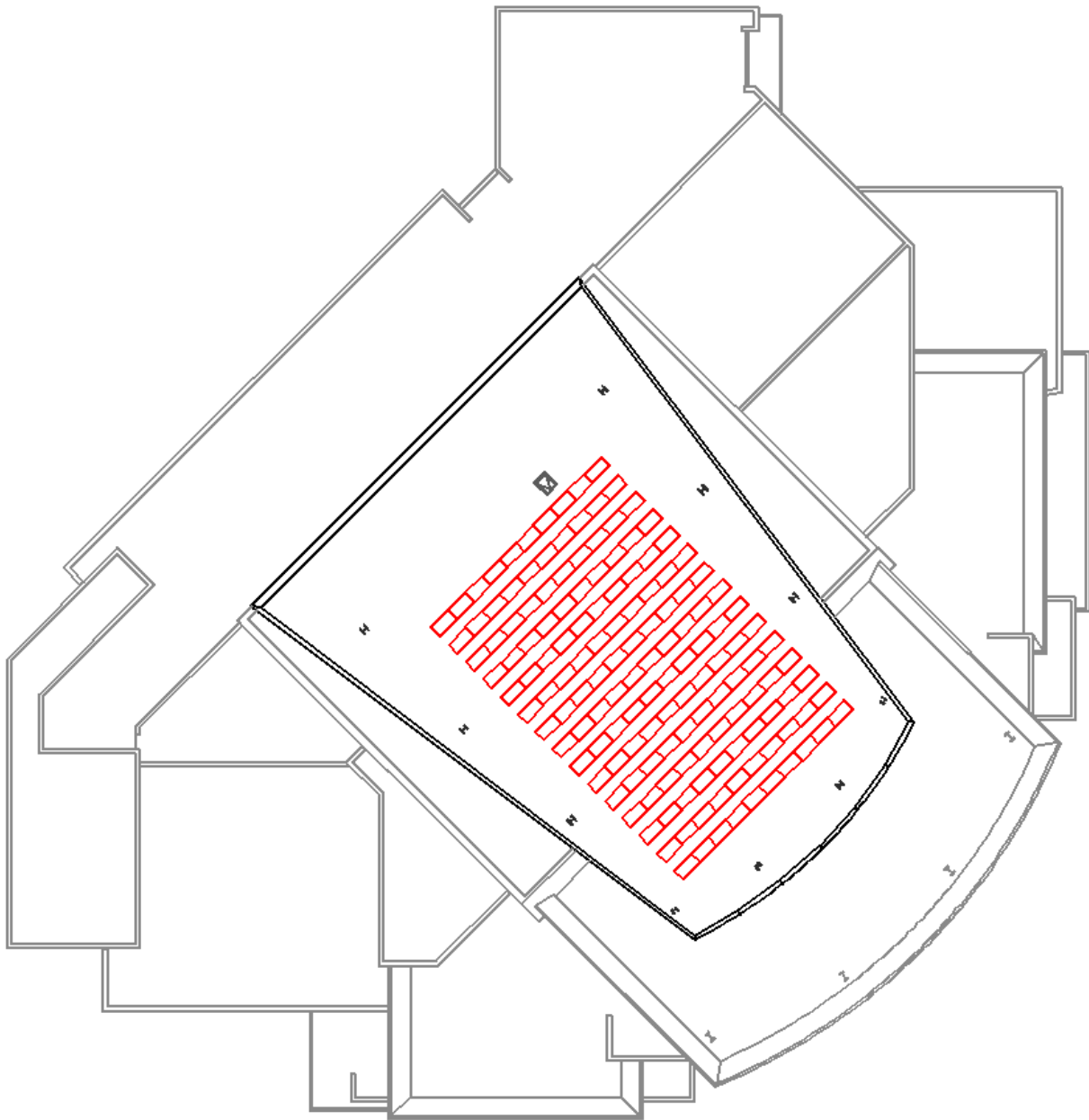
The inverter is a PV Powered PVP35kW-480, which converts from a maximum of 125 A and 600 V_{DC} to AC at 480V. It can convert up to 36.5 kW_{DC} to 35 kW_{AC}. The inverter cost is estimated at \$0.37 per W_{DC}. Additional costs, such as installation and installer margin are estimated to cost \$1.72 per W_{DC}.

A single inverter is used instead of microinverters because the concert hall is the highest building in the area, and inter-row shading wouldn't differ between strings because of the regular layout.

Layout

The roof has a very slight north facing slope, from 753 ft. elevation at the southeast edge, to 748 ft. toward the northwest. Modules are sloped at a relatively shallow 15 degrees, to allow tighter spacing without inter-row shading on the space constrained roof. The panels are arranged for 50% cover. They face southeast, to align with the roof and account for the building's heavier use earlier in the day.

Figure 23: Photovoltaic Array Layout



The panels extend to a closest distance of 6 feet from the edge of the roof. They are arranged in 15 rows of 10, for a total of 150 panels. Each row of 10 panels is connected in series to produce a maximum of $470V_{DC}$.

Output

With 150 panels at $210.1 W_{DC}$, the system produces a maximum of $315.2 kW_{DC}$. According to a simulation run in NREL's System Advisor Model, it has an annual estimated output of 39,440 kWh.

Electrical Connection

Each string has a short circuit current of 5.75A, and is protected and isolated by a small solar fuse to prevent overcurrent or reverse current in case of a fault in a string. These fuses are sized at 9A (the next size above 150% I_{sc}) and are located in a solar combiner box, which collects the DC from each string and combines it into a single DC output, which is sent to the inverter.

The inverter takes the DC current and converts to AC at 480Y/277 V, which is fed into the main switchboard. Its peak output is 35 kW at minimum 0.99 power factor. This gives a current of 73 A, and can be connected with size 3 AWG wires.

Economics

The economics are analyzed for a 25 year period with a projected inflation of 2%, real discount rate of 5.20%. In accordance with Illinois' Special Assessment for Solar Energy Systems, the property taxes are assessed at the price of a standard electrical system. It uses 5 year accelerated depreciation at the federal and state level.

Illinois doesn't currently have a market for Solar Renewable Energy Credits, but they will begin in energy year June 2012 to May 2013. It is difficult to predict how this market will perform over the next 25 years, but I have assumed a price of \$100 per MWh for 15 years. The SRECs are purchased by utility companies from independent solar operators to count toward minimum renewable generation requirements.

The estimated real levelized cost of energy of the system is 13.43 ¢/kWh. This is higher than the current electric rate, but due to inflation and increasing electric rates, the system should pay off after 22.7 years. Since the system is expected to last 25-30 years, it shouldn't lose money, but it may not be the best investment. It is more justifiable as an effort to reduce dependence on energy produced by fossil fuels than as a long term financial investment.

Conclusion

The design solutions presented here are aimed largely at reducing the Wentz Concert Hall and Fine Arts Center's electrical demands, and at creating a lighting design scheme that ties into the architectural style to achieve its effect without requiring large amounts of power. The lobby lighting is both welcoming and efficient, the concert hall has drastically reduced power requirements while giving it an even more memorable appearance, and the façade's colored top level marks the center as an important building from far away. As a long lasting institution established in 1861, North Central College has an interest looking to the future and reducing its energy dependence. These alternate designs are a good start to moving the college toward that goal.

Acknowledgements

Thank you to my thesis advisors, Dr. Richard Mistrick and Prof. Ted Dannerth for their assistance throughout this project, and to Prof. Robert Holland and Prof. Kevin Parfitt for their efforts as senior thesis coordinators.

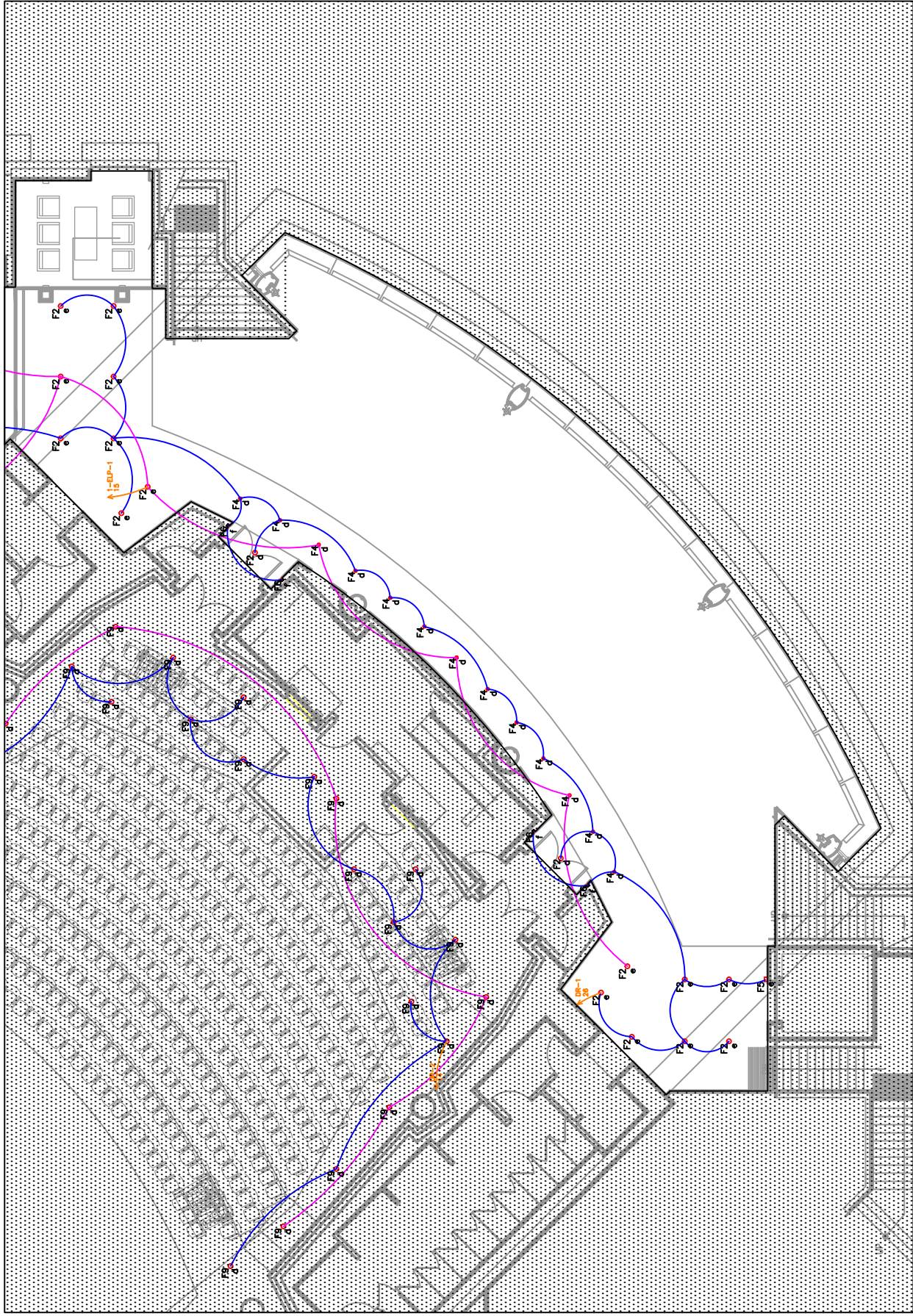
Thanks to Emily Klingensmith at Schuler Shook for her help with obtaining a building for this thesis, and to Mike Hudson and Donald Koletsos at North Central College for giving me a tour of the facility and answering questions about its design and construction.

Thank you to everyone at Schuler Shook for all that I learned during my internship there.

A special thanks to all of my friends and family, who have been incredibly supportive through my time at Penn State.

Appendix A

Electrical Plans

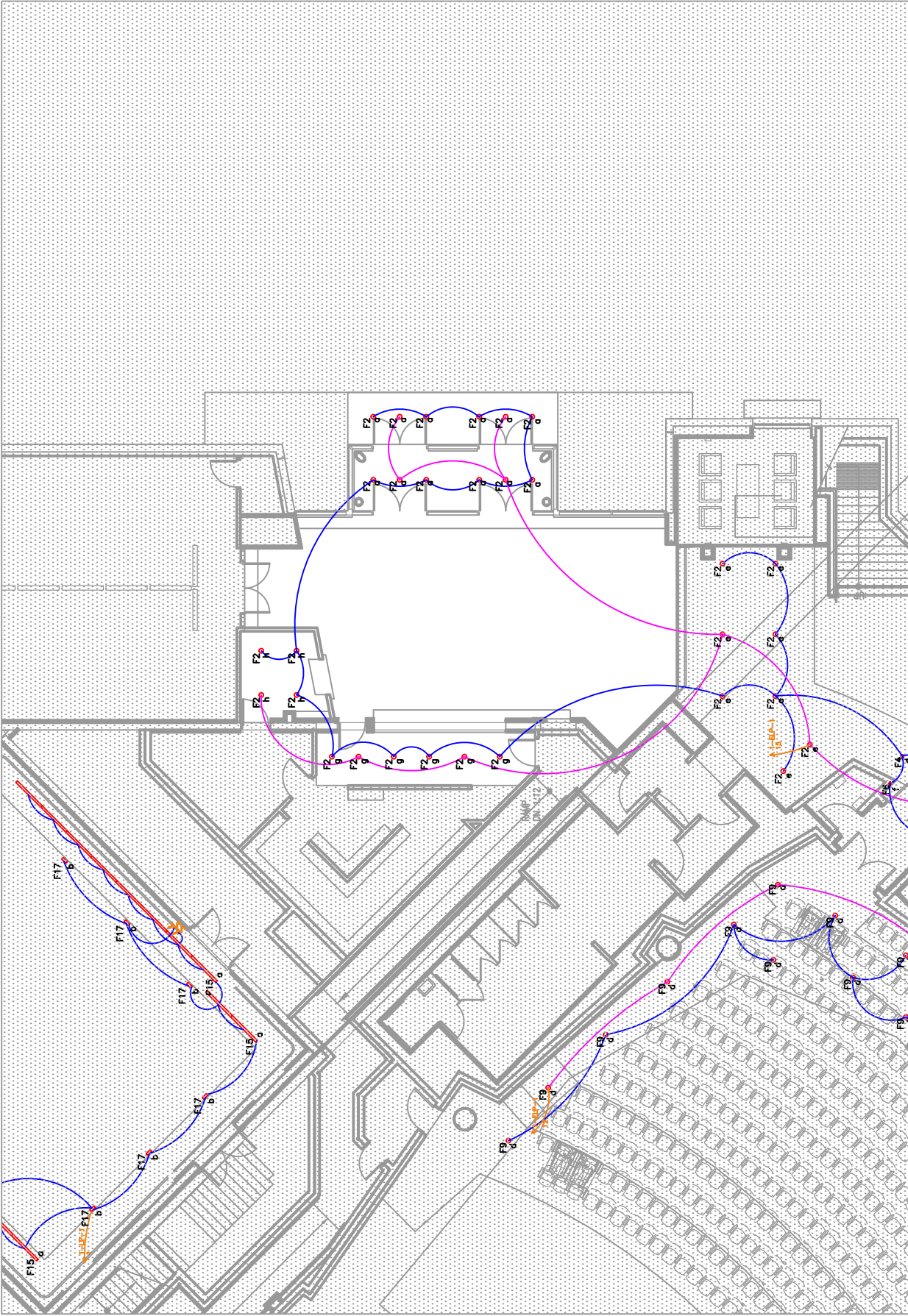


Main Lobby – 1st level lighting plan (South)

Drawn: 3/31/2012

Scale: 1/16" = 1'

E1

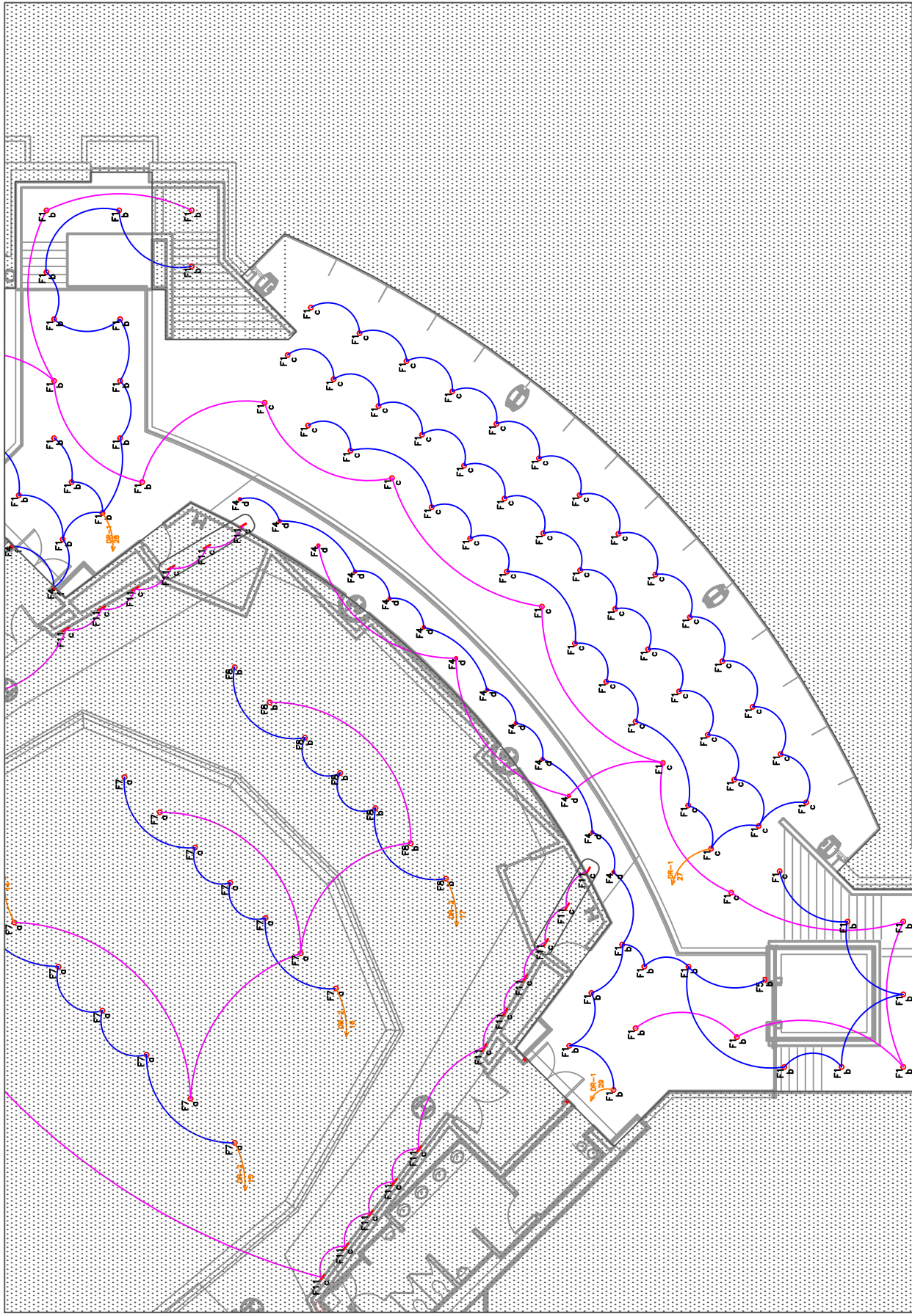


Main Lobby – 1st level lighting plan (North)

Drawn: 3/31/2012

Scale: 1/16" = 1'

E2

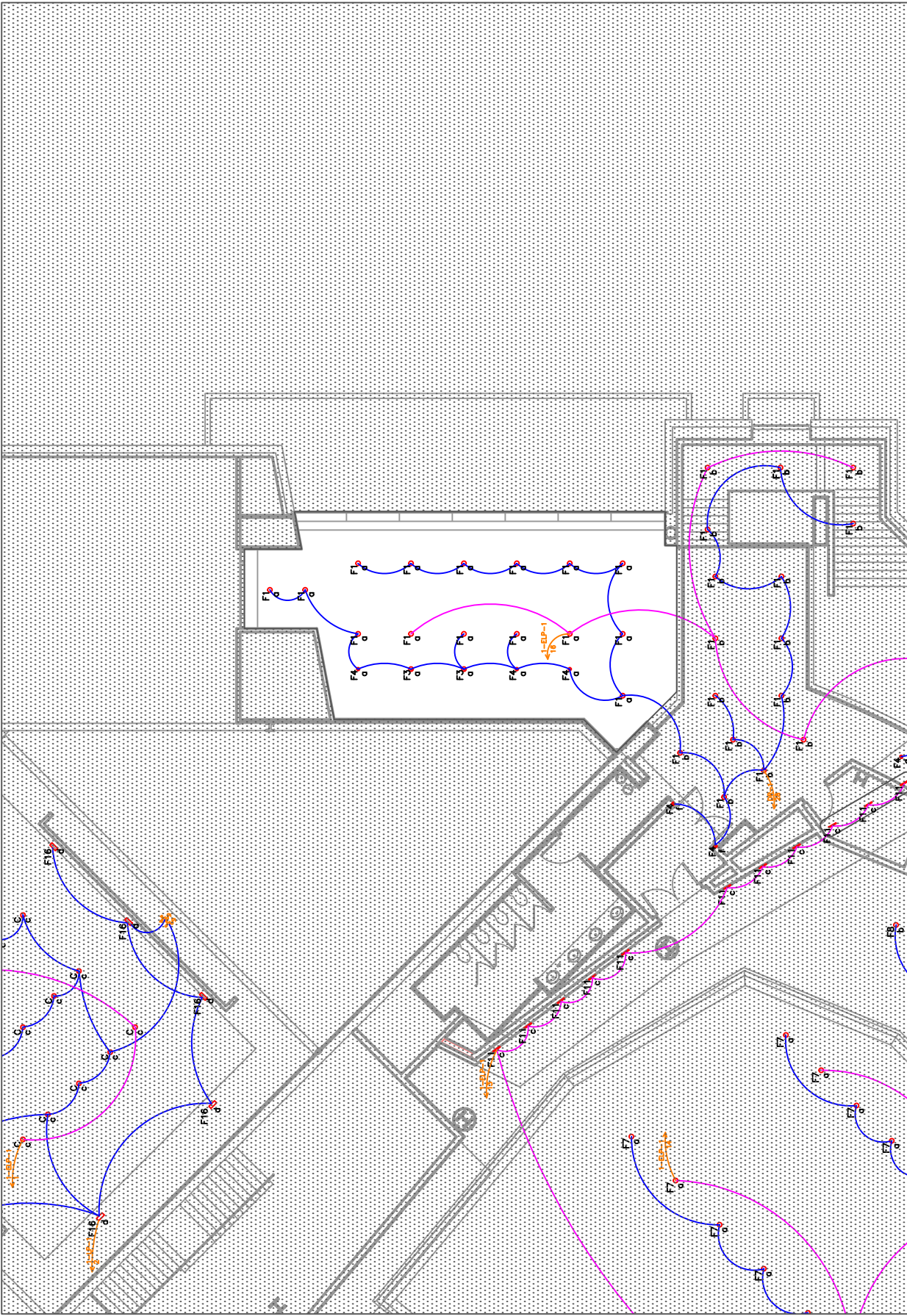


Main Lobby - Balcony level lighting plan (South)

E3

Drawn: 3/31/2012

Scale: 1/16" = 1'

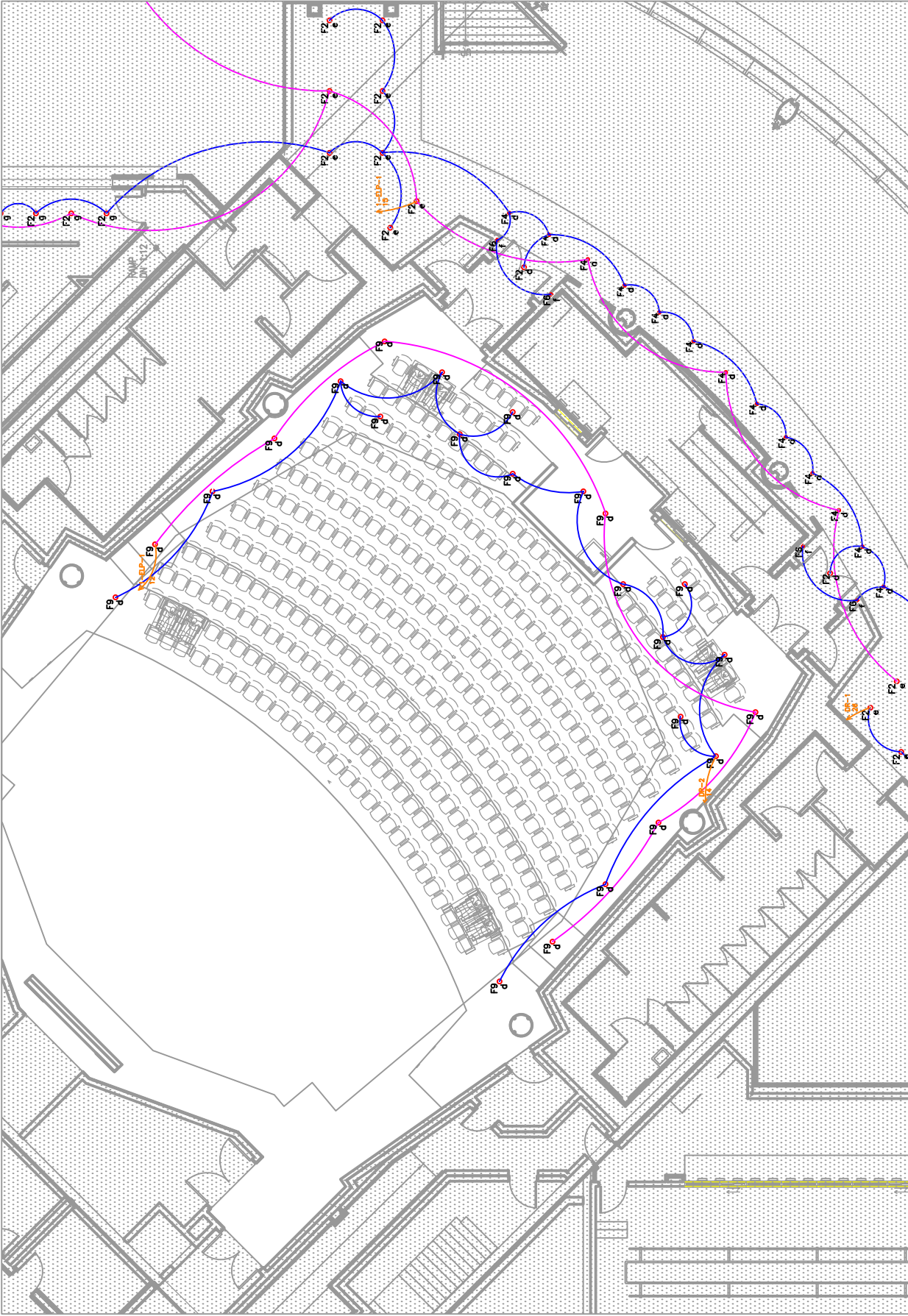


Main Lobby – Balcony level lighting plan (North)

E4

Drawn: 3/31/2012

Scale: 1/16" = 1'

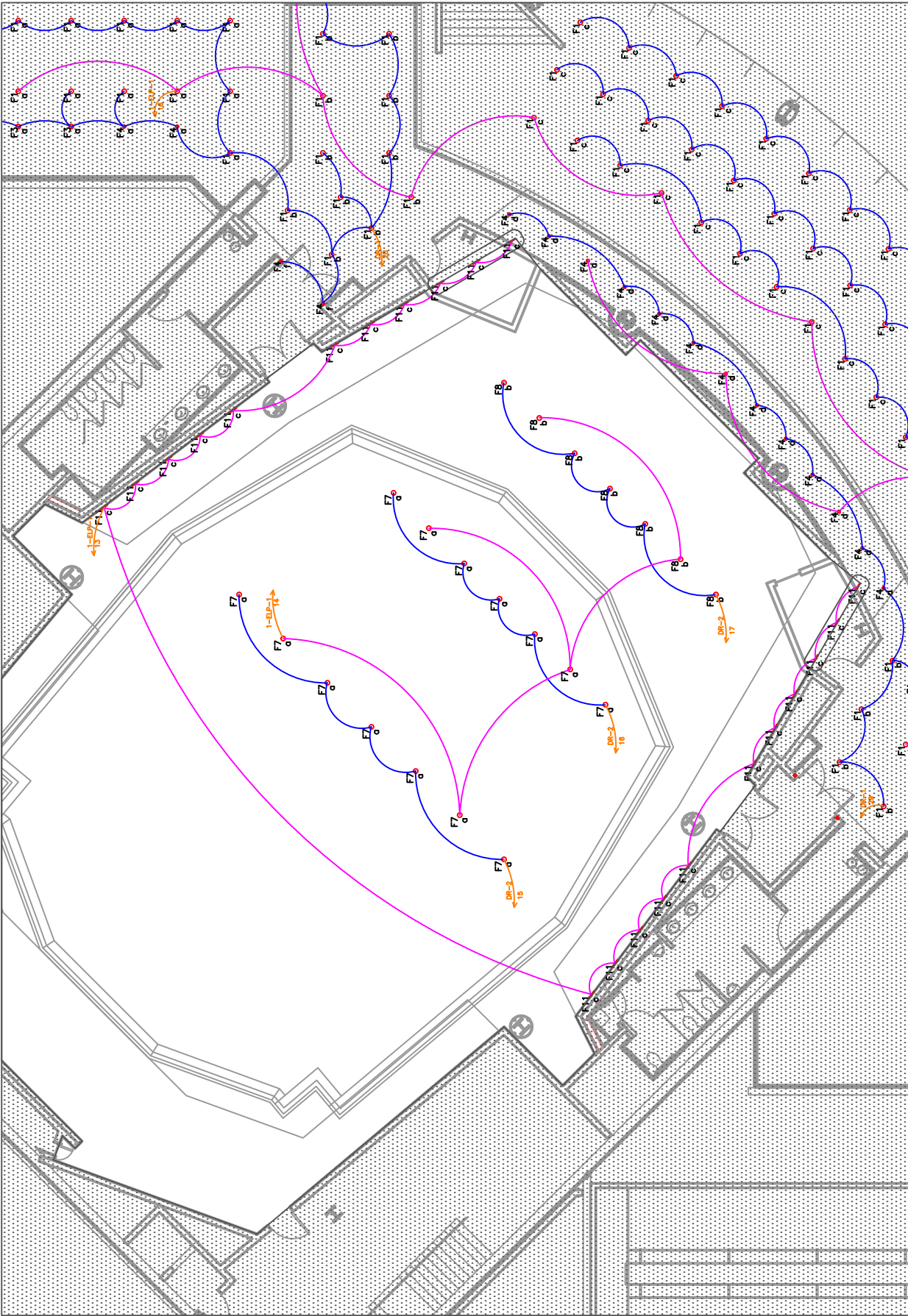


Concert Hall – 1st level lighting plan

E5

Drawn: 3/31/2012

Scale: 1/16" = 1'

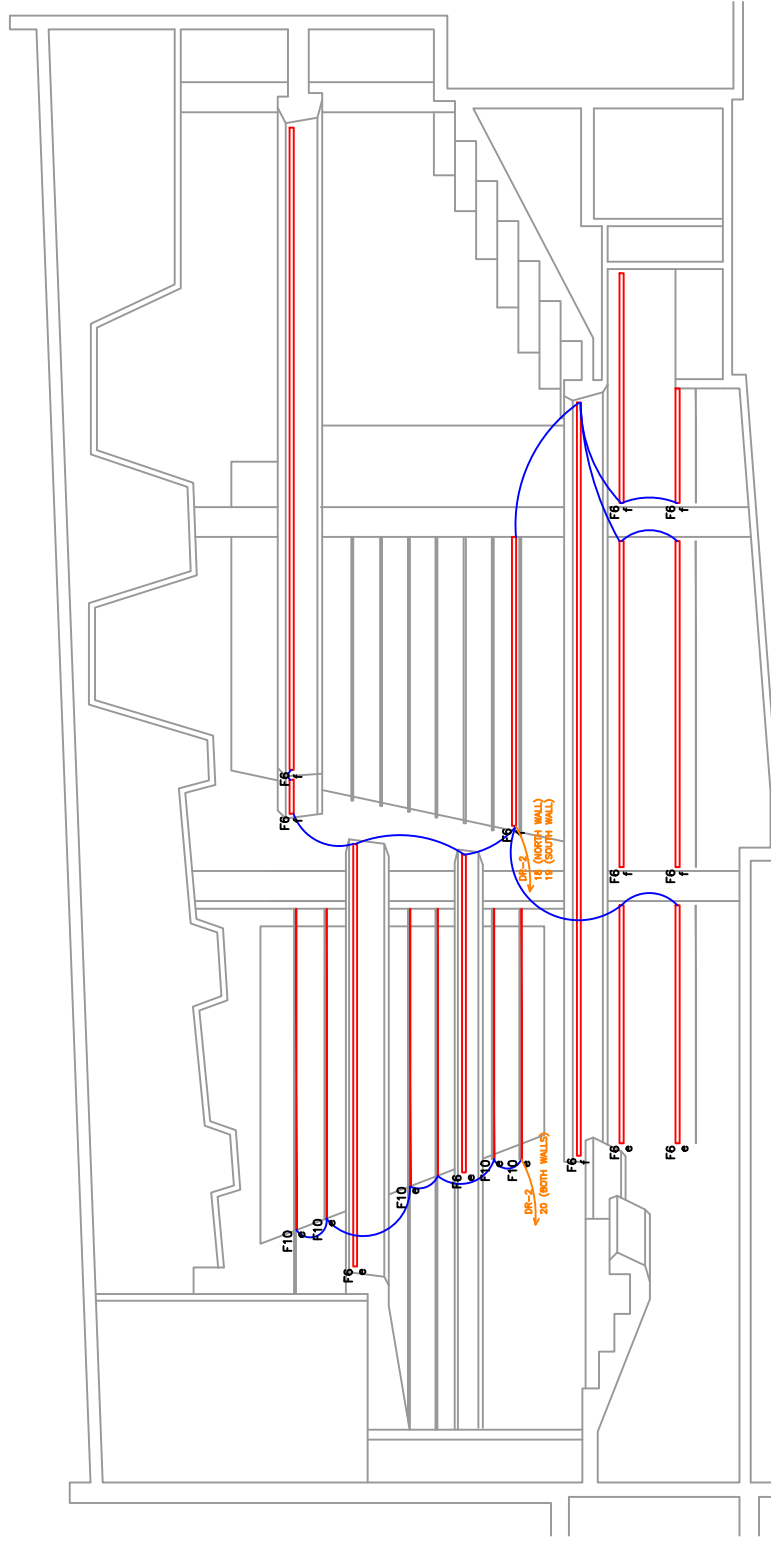


E6

Concert Hall – Balcony level lighting plan

Drawn: 3/31/2012

Scale: 1/16" = 1'



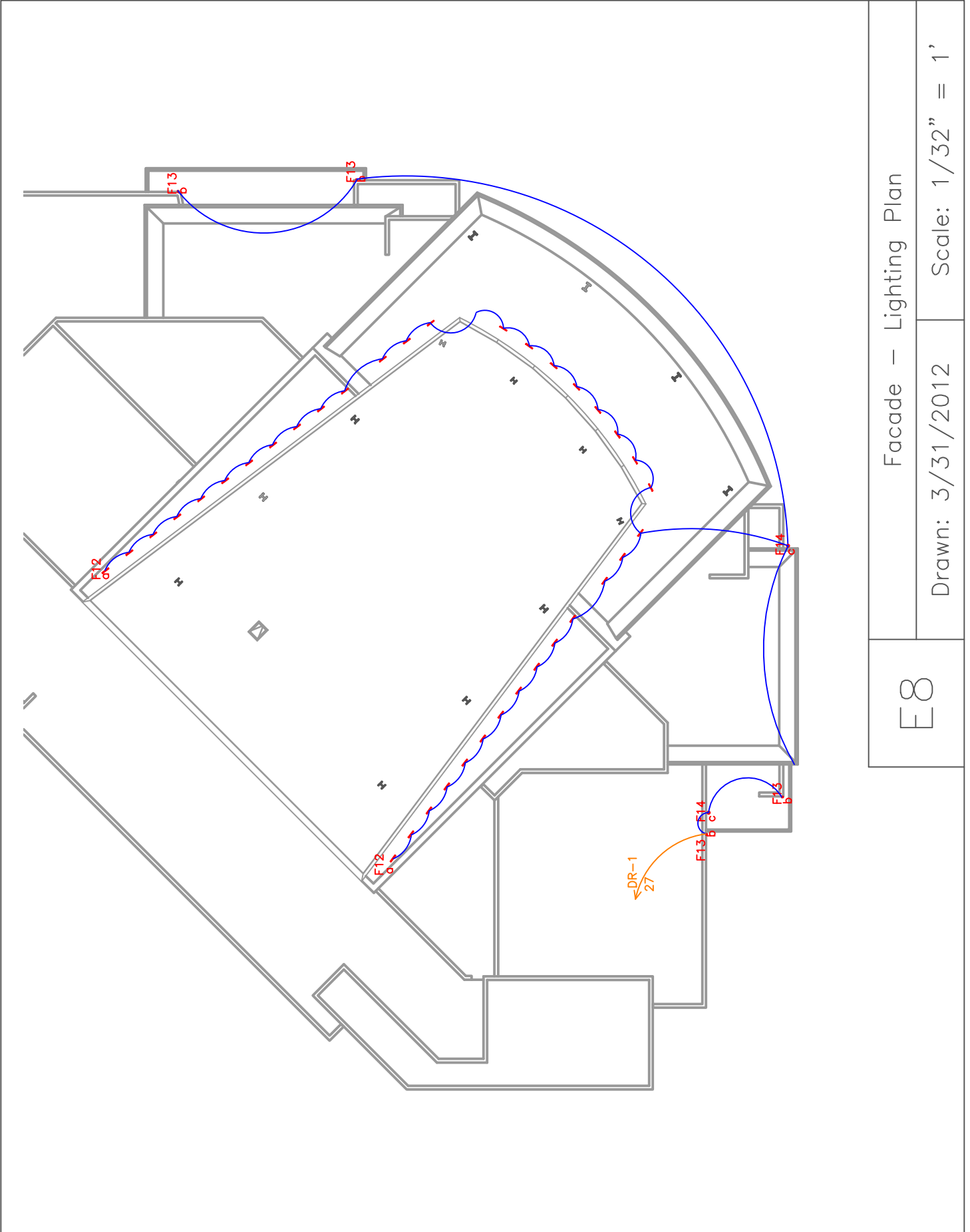
E7

Concert Hall – Side Wall Lighting Plan

Drawn: 3/31/2012

Scale: 1/16" = 1'

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT



Facade - Lighting Plan

Drawn: 3/31/2012

Scale: 1/32" = 1'

E8

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

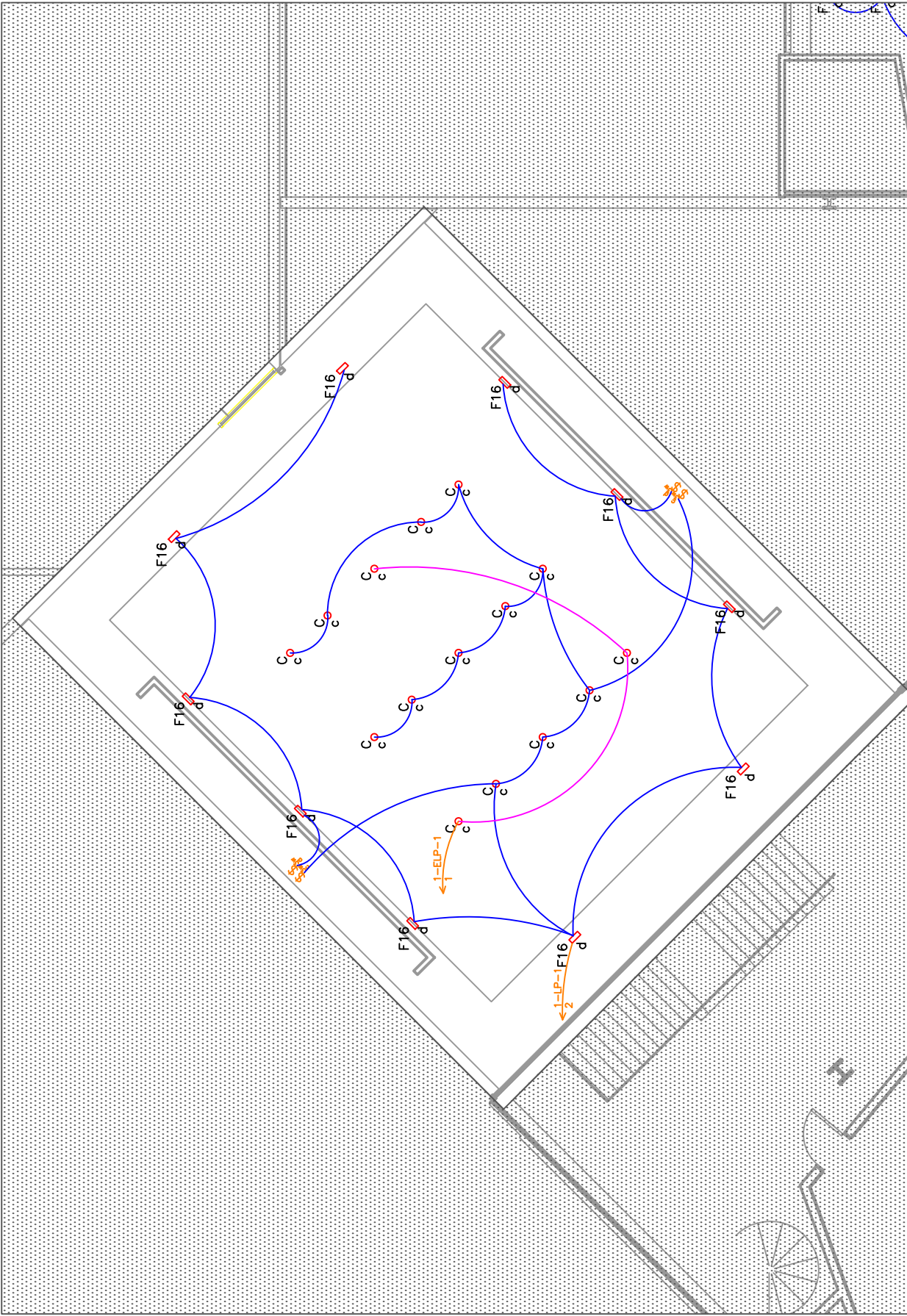


Rehearsal Room – 1st level lighting plan

E9

Drawn: 3/31/2012

Scale: 3/32" = 1'



Rehearsal Room – Balcony level lighting plan

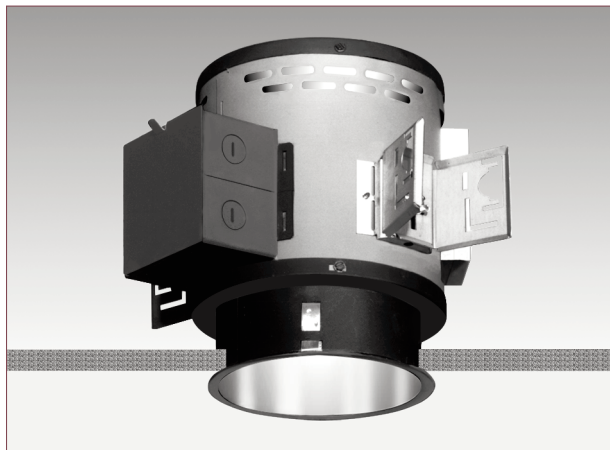
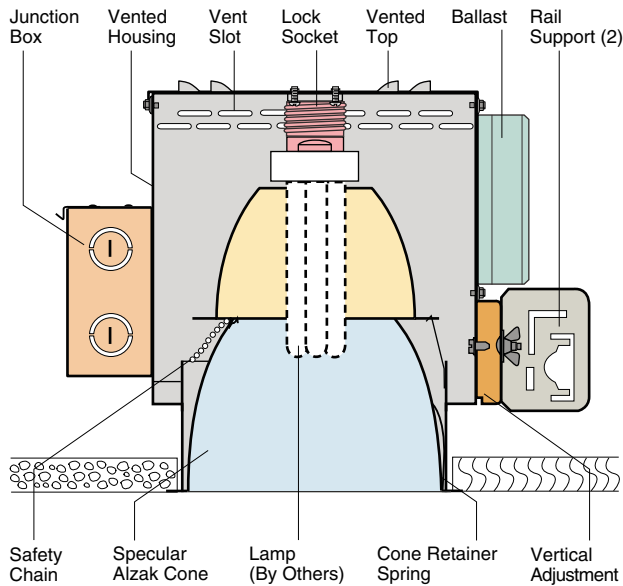
E10

Drawn: 3/31/2012

Scale: 3/32" = 1'

Appendix B

Luminaires, Lamps, and Ballasts



P926 One 26W or 32W Triple Tube Lamp
P927 One 42W Triple Tube Lamp

Medium Beam
5 7/8" Conoid Apertures

Optics and Applications

Distribution from a single vertically mounted triple tube lamp is for general lighting. Spacing to mounting height ratios range from .93 to 1.11 depending upon which lamp is mounted. Use in corridors, entries, work stations or open area lighting in low to medium height ceilings.

Design Features

The two reflector optical system is protected by a rigid steel housing which keeps the reflectors in proper relationship to each other. The twist and lock socket prevents the lamp from falling if it is not properly engaged. It is a dependable fail-safe mechanism to prevent injury and litigation. Maximum ceiling thickness is 2". Ballast and lamp service from below.

Finish

Specular clear Alzak cones are standard. Optional colors and Softglow® finishes are available. Housings and structural parts are painted optical matte black to suppress stray light leaks. Steel parts are phosphate conditioned for corrosion resistance before painting.

Ballasts

Fully electronic, microprocessor controlled with variable starting current for inrush protection to assure rated lamp life. Input voltage ranges from 120V through 277V. Power factor .98, starting temperature 0° F (-18° C), THD < 10%. Pre-heat start < 1.0 second. End of lamp life protection. Rated for > 50,000 starts.

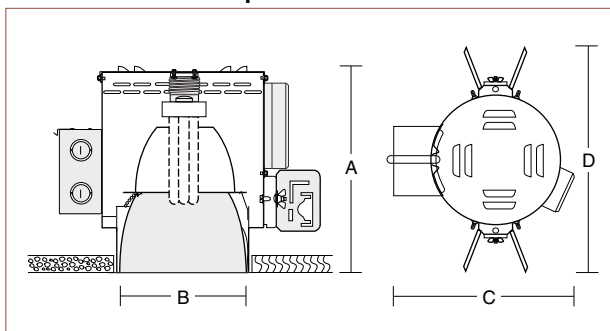
General

Fixtures are pre-wired, UL and C-UL listed for eight wire 75°C branch circuit wiring. Union made IBEW. Luminaire Efficiency Rating (LER) data is in the photometric directory located in Section Z.

Accessories

- G Gold cone.
- H Mocha cone.
- P Graphite cone.
- T Titanium cone.
- W Wheat cone.
- Y Pewter cone.
- Z Bronze cone.
- S Softglow® finishes: add S before color letters. e.g. SW for Softglow® wheat cone, SC for Softglow® clear cone.
- DM Dimming ballast. Specify watts and volts.
- EM Emergency power includes integral charger light and test switch visible through aperture. Single lamp operation for 90 minutes. Specify volts.
- WRL Wattage restriction label, specify wattage.
- R2 26" support rails.
- R5 52" support rails.
- WT White trim flange.
- WHT White complete trim.
- V347 347 volt ballast.
- F Fuse.

Dimensions and Lamps



| Number | A Depth* | B Aperture | C Width | D Length | Lamps |
|--------|------------------|-----------------|------------------|------------------|------------------------|
| P926 | 9 3/4" 248mm | 5 7/8" 149mm | 10 1/2" 267mm | 13 1/4" 337mm | 26W or 32W Triple Tube |
| P927 | 10 1/4" 260mm | 5 7/8" 149mm | 10 1/2" 267mm | 13 1/4" 337mm | 42W Triple Tube |

*Recess depth increases to 12 1/2" with EM and DM accessories.

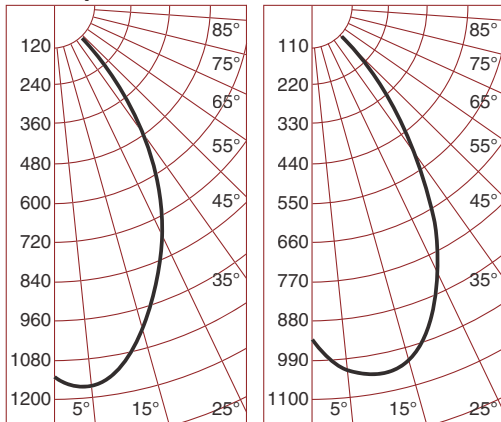
P51 P926 P927

Performance Datachart

| Single Unit Initial Footcandles, 30" Work Plane | | | | | | Ceiling to Floor | Multiple Units Initial Footcandles, 30" Work Plane | | | |
|---|----------|----------|----------|----------|----------|------------------|--|----------|----------|------|
| P926 One 32W Osram Triple Tube Read Top Data | | | | | | 8' | Ceiling 80% Walls 50% Floor 20% | | | |
| P927 One 42W Osram Triple Tube Read Bottom Data | | | | | | | Spacing is Maximum Over Work Plane | | | |
| Nadir | 10° | | 20° | | 30° | Spacing | RCR 1 | RCR 3 | RCR 8 | |
| FC | FC | Diam | FC | Diam | FC | | | | | Diam |
| 37 47 | 35 42 | 2' 2' | 25 30 | 4' 4' | 13 17 | 6' | 49 66 | 42 56 | 30 39 | |
| 27 33 | 25 30 | 2' 2' | 18 21 | 5' 5' | 10 12 | 8' | 35 47 | 30 40 | 21 28 | |
| 20 25 | 19 23 | 3' 3' | 14 16 | 5' 5' | 7 9 | 9' | 26 36 | 23 30 | 16 21 | |
| 13 16 | 12 14 | 3' 3' | 8 10 | 7' 7' | 4 6 | 11' | 17 22 | 14 19 | 10 13 | |
| 9 11 | 8 10 | 4' 4' | 6 7 | 8' 8' | 3 4 | 13' | 11 11 | 10 15 | 7 9 | |

See notes 4, 5 and 6.

Candlepower Distribution



P926 32W Triple Tube Osram
Eff. 50% S/M .95

P926 32W Triple Tube Philips
Eff. 50% S/M 1.11

Candelas

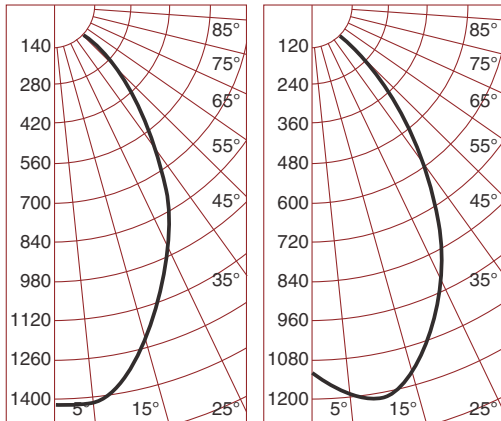
| o | O 32W | P 32W |
|----|-------|-------|
| | 2400* | 2400* |
| 0 | 1134 | 938 |
| 5 | 1152 | 1021 |
| 10 | 1109 | 1055 |
| 15 | 1023 | 1020 |
| 20 | 916 | 956 |
| 25 | 789 | 837 |
| 30 | 625 | 667 |
| 35 | 460 | 467 |
| 40 | 353 | 321 |
| 45 | 212 | 173 |
| 50 | 19 | 16 |
| 55 | 7 | 6 |
| 60 | 0 | 0 |
| 65 | 0 | 0 |
| 70 | 0 | 0 |
| 75 | 0 | 0 |
| 80 | 0 | 0 |
| 85 | 0 | 0 |
| 90 | 0 | 0 |

o Vertical Angles
* Initial Lamp Lumens

Coefficients of Utilization

| Ceiling | 80% | | | | 70% | | | | 50% | | | | 30% | | | | 0 | | | | | |
|---------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 70 | 50 | 30 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 0 | | | | | |
| RCR | Zonal Cavity Method - Floor Reflectance 20% | | | | | | | | | | | | | | | | | | | | | |
| 1 | .57 | .56 | .55 | .53 | .55 | .52 | .53 | .51 | .51 | .49 | .47 | .57 | .56 | .55 | .53 | .55 | .52 | .53 | .51 | .51 | .49 | .47 |
| 2 | .54 | .52 | .50 | .48 | .51 | .47 | .49 | .46 | .48 | .45 | .43 | .54 | .52 | .50 | .48 | .51 | .47 | .49 | .46 | .48 | .45 | .43 |
| 3 | .51 | .48 | .45 | .43 | .47 | .43 | .46 | .42 | .45 | .41 | .40 | .51 | .48 | .45 | .43 | .47 | .43 | .46 | .42 | .45 | .41 | .40 |
| 4 | .48 | .44 | .41 | .39 | .44 | .39 | .43 | .38 | .42 | .38 | .37 | .48 | .44 | .41 | .39 | .44 | .39 | .43 | .38 | .42 | .38 | .37 |
| 5 | .46 | .41 | .38 | .36 | .41 | .36 | .40 | .35 | .39 | .35 | .34 | .46 | .41 | .38 | .36 | .41 | .36 | .40 | .35 | .39 | .35 | .34 |
| 6 | .43 | .38 | .35 | .33 | .38 | .33 | .37 | .33 | .36 | .32 | .31 | .43 | .38 | .35 | .33 | .38 | .33 | .37 | .33 | .36 | .32 | .31 |
| 7 | .41 | .36 | .33 | .30 | .35 | .30 | .35 | .30 | .34 | .30 | .29 | .41 | .36 | .33 | .30 | .35 | .30 | .35 | .30 | .34 | .30 | .29 |
| 8 | .39 | .34 | .30 | .28 | .33 | .28 | .33 | .28 | .32 | .28 | .27 | .39 | .34 | .30 | .28 | .33 | .28 | .33 | .28 | .32 | .28 | .27 |
| 9 | .37 | .31 | .28 | .26 | .31 | .26 | .31 | .26 | .30 | .26 | .25 | .37 | .31 | .28 | .26 | .31 | .26 | .31 | .26 | .30 | .26 | .25 |
| 10 | .35 | .30 | .26 | .24 | .29 | .24 | .29 | .24 | .28 | .24 | .23 | .35 | .30 | .26 | .24 | .29 | .24 | .29 | .24 | .28 | .24 | .23 |

P926 One 32W Triple Tube Osram Sylvania
P926 One 32W Triple Tube Philips x .98



P927 42W Triple Tube Osram
Eff. 48% S/M .93

P927 42W Triple Tube Philips
Eff. 44% S/M 1.07

| o | O 42W | P 42W |
|----|-------|-------|
| | 3200* | 3200* |
| 0 | 1412 | 1104 |
| 5 | 1403 | 1188 |
| 10 | 1328 | 1211 |
| 15 | 1176 | 1154 |
| 20 | 1092 | 1063 |
| 25 | 958 | 919 |
| 30 | 789 | 747 |
| 35 | 611 | 583 |
| 40 | 487 | 441 |
| 45 | 355 | 253 |
| 50 | 75 | 23 |
| 55 | 10 | 8 |
| 60 | 0 | 0 |
| 65 | 0 | 0 |
| 70 | 0 | 0 |
| 75 | 0 | 0 |
| 80 | 0 | 0 |
| 85 | 0 | 0 |
| 90 | 0 | 0 |

o Vertical Angles
* Initial Lamp Lumens

| Ceiling | 80% | | | | 70% | | | | 50% | | | | 30% | | | | 0 | | | | | |
|---------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 70 | 50 | 30 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 0 | | | | | |
| RCR | Zonal Cavity Method - Floor Reflectance 20% | | | | | | | | | | | | | | | | | | | | | |
| 1 | .56 | .55 | .54 | .53 | .54 | .52 | .52 | .50 | .50 | .49 | .46 | .56 | .55 | .54 | .53 | .54 | .52 | .52 | .50 | .50 | .49 | .46 |
| 2 | .53 | .51 | .49 | .47 | .50 | .47 | .48 | .46 | .47 | .45 | .43 | .53 | .51 | .49 | .47 | .50 | .47 | .48 | .46 | .47 | .45 | .43 |
| 3 | .51 | .47 | .45 | .43 | .47 | .42 | .45 | .42 | .44 | .41 | .39 | .51 | .47 | .45 | .43 | .47 | .42 | .45 | .42 | .44 | .41 | .39 |
| 4 | .48 | .44 | .41 | .39 | .43 | .38 | .42 | .38 | .41 | .38 | .36 | .48 | .44 | .41 | .39 | .43 | .38 | .42 | .38 | .41 | .38 | .36 |
| 5 | .45 | .41 | .38 | .35 | .40 | .35 | .39 | .35 | .39 | .35 | .34 | .45 | .41 | .38 | .35 | .40 | .35 | .39 | .35 | .39 | .35 | .34 |
| 6 | .43 | .38 | .35 | .33 | .38 | .32 | .37 | .32 | .36 | .32 | .31 | .43 | .38 | .35 | .33 | .38 | .32 | .37 | .32 | .36 | .32 | .31 |
| 7 | .40 | .35 | .32 | .30 | .35 | .30 | .34 | .30 | .34 | .30 | .29 | .40 | .35 | .32 | .30 | .35 | .30 | .34 | .30 | .34 | .30 | .29 |
| 8 | .38 | .33 | .30 | .28 | .33 | .28 | .32 | .28 | .32 | .27 | .27 | .38 | .33 | .30 | .28 | .33 | .28 | .32 | .28 | .32 | .27 | .27 |
| 9 | .36 | .31 | .28 | .26 | .31 | .26 | .30 | .26 | .30 | .26 | .25 | .36 | .31 | .28 | .26 | .31 | .26 | .30 | .26 | .30 | .26 | .25 |
| 10 | .34 | .29 | .26 | .24 | .29 | .24 | .29 | .24 | .28 | .24 | .23 | .34 | .29 | .26 | .24 | .29 | .24 | .29 | .24 | .28 | .24 | .23 |

P927 One 42W Triple Tube Osram Sylvania
P927 One 42W Triple Tube Philips x .89

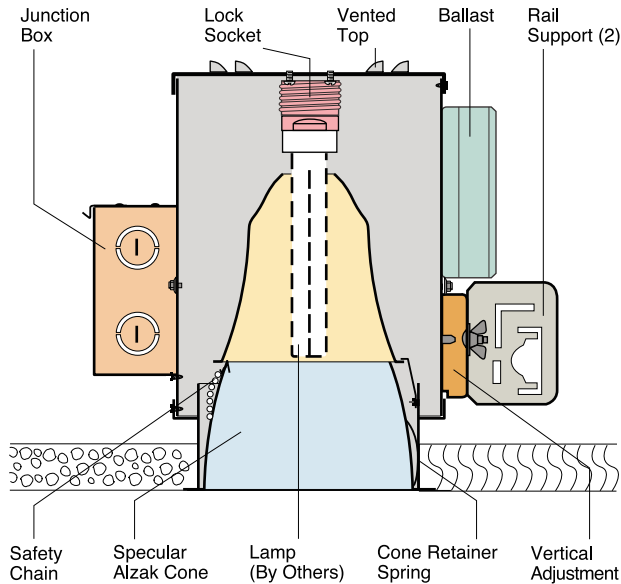
Brightness

| Number | Lamps | 85° | 75° | 65° | 55° | 45° |
|--------|--------------------------------|-----|-----|-----|-----|-------|
| P926 | 32W Osram Sylvania Triple Tube | 10 | 33 | 66 | 150 | 12837 |
| | 32W Philips Triple Tube | 12 | 34 | 62 | 151 | 10756 |
| P927 | 42W Osram Sylvania Triple Tube | 14 | 45 | 91 | 208 | 17796 |
| | 42W Philips Triple Tube | 15 | 45 | 82 | 203 | 14468 |

Data in footlamberts. Photometer readings, Maximum Brightness Method. See note 7.

Notes

- Data on all charts calculated with a clear specular cone finish.
- Specular cone multipliers: Wheat x .84, Pewter x .79, Mocha x .78, Graphite x .75, Titanium x .75, Bronze x .72.
- Softglow® cone multipliers: Wheat x .71, Mocha x .68, Pewter x .65, Graphite x .64, Titanium x .64, Bronze x .61.
- Single unit Datachart pattern diameters are determined by the number of degrees from each side of nadir. Therefore a 20° diameter represents a total 40° pattern width at the work plane 30" above the floor. Footcandle values are at the edge of that diameter.
- Datachart spacing is rounded off to the nearest foot.
- Data by IES methods. Compact fluorescent data vary due to lamp differences, power input, burning position, ambient temperature and ballast characteristics. Apply a modification factor.
- Brightness data from the Average Luminance Method are inaccurate for small aperture downlights. They are theoretical calculations derived for large surfaces such as troffers. For a complete discussion refer to section Z brochure Z1.



P626

Narrow Beam
One 26W Quad Tube Lamp
5 7/8" Conoid Aperture

Optics and Applications

Narrower distribution for general and task lighting from a single vertically mounted quad tube lamp. Spacing to mounting height ratio is .81 with a soft edge pattern. Use in corridors, entries and over work stations.

Design Features

The optical system has a computer designed primary reflector and a parabolic low brightness shielding cone. A twist and lock socket prevents the lamp from falling if it is not properly engaged. It is a dependable fail-safe mechanism to prevent injury and litigation. Maximum ceiling thickness 2". Ballast and lamp service from below.

Finish

A specular clear Alzak cone is standard. Optional colors and Softglow® finishes are available. The housing and all structural parts are phosphated for corrosion resistance before being painted optical matte black for control of stray light leaks.

Ballast

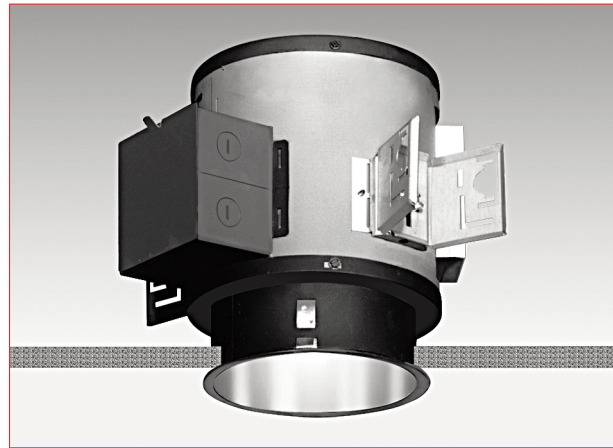
Fully electronic, microprocessor controlled with variable starting current for inrush protection to assure rated lamp life. Input voltage range from 120V through 277V. Power factor .98, starting temperature 0°F (-18°C), THD < 10%. Pre-heat start < 1.0 second. End of lamp life protection. Rated for > 50,000 starts.

General

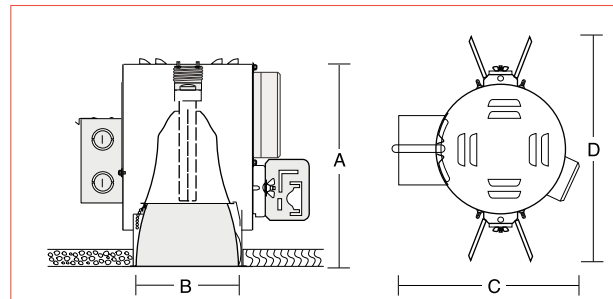
Fixtures are pre-wired, UL and C-UL listed for eight wire 75°C branch circuit wiring. Union made IBEW. Luminaire Efficiency Rating (LER) data is in the photometric directory located in Section Z.

Accessories

- G Gold cone.
- H Mocha cone.
- P Graphite cone.
- T Titanium cone.
- W Wheat cone.
- Y Pewter cone.
- Z Bronze cone.
- S Softglow® finishes: add S before color letters. e.g. SW for Softglow® wheat cone, SC for Softglow® clear cone.
- R2 26" support rails.
- R5 52" support rails.
- WT White trim flange.
- WHT White complete trim.
- V347 347 volt ballast.
- F Fuse.
- DM Dimming ballast. Specify watts and volts.
- EM Emergency power includes integral charger light and test switch visible through aperture. Single lamp operation for 90 minutes. Specify volts.



Dimensions and Lamps



| Number | A Depth* | B Aperture | C Width | D Length | Lamps |
|--------|------------------|-----------------|------------------|------------------|-------------------|
| P626 | 11 1/2" 292mm | 5 7/8" 149mm | 10 1/2" 267mm | 13 1/4" 337mm | One 26W Quad Tube |

For 18W lamps, add W 18 to catalog number.
 *Recess depth increases to 13" with EM and DM accessories.

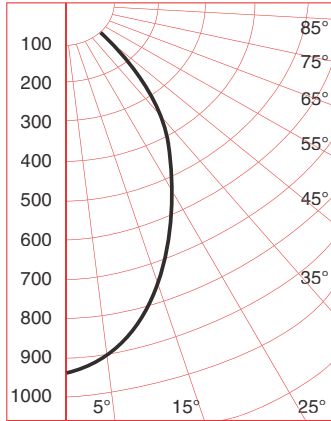
P2 P626

Performance Datachart

| Single Unit Initial Footcandles, 30" Work Plane | | | | | | Ceiling to Floor | | Multiple Units Initial Footcandles, 30" Work Plane | | | |
|---|----|------|----|------|----|------------------|---------|--|-------|-------|----|
| P626 One 26W Quad Tube lamp | | | | | | | | Ceiling 80% Walls 50% Floor 20% | | | |
| Nadir | | | | | | | | Spacing is Maximum Over Work Plane | | | |
| 15° | | 25° | | 35° | | | | | | | |
| FC | FC | Diam | FC | Diam | FC | Diam | Spacing | RCR 1 | RCR 3 | RCR 8 | |
| 31 | 22 | 3' | 13 | 5' | 6 | 8' | 8' | 4' | 47 | 41 | 29 |
| 23 | 16 | 3' | 9 | 6' | 4 | 9' | 9' | 5' | 34 | 29 | 21 |
| 17 | 12 | 4' | 7 | 7' | 3 | 11' | 10' | 6' | 25 | 22 | 16 |
| 13 | 9 | 5' | 6 | 8' | 3 | 12' | 11' | 7' | 20 | 17 | 12 |
| 11 | 8 | 5' | 4 | 9' | 2 | 13' | 12' | 8' | 16 | 14 | 10 |

See notes 4 and 5.

Candlepower Distribution



P626 One 26W Quad Tube lamp
Eff. 48% S/M .81

Candelas

| | 26W |
|----|-------|
| o | 1800* |
| 0 | 952 |
| 5 | 907 |
| 10 | 832 |
| 15 | 752 |
| 20 | 649 |
| 25 | 534 |
| 30 | 422 |
| 35 | 342 |
| 40 | 256 |
| 45 | 120 |
| 50 | 28 |
| 55 | 4 |
| 60 | 0 |
| 65 | 0 |
| 70 | 0 |
| 75 | 0 |
| 80 | 0 |
| 85 | 0 |
| 90 | 0 |

o Vertical Angles
* Initial Lamp Lumens

Coefficients of Utilization

| Ceiling | 80% | | | | 70% | | 50% | | 30% | | 0 |
|---------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 70 | 50 | 30 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 0 |
| Wall % | Zonal Cavity Method - Floor Reflectance 20% | | | | | | | | | | |
| RCR | Zonal Cavity Method - Floor Reflectance 20% | | | | | | | | | | |
| 1 | .54 | .52 | .51 | .50 | .51 | .49 | .49 | .48 | .47 | .46 | .44 |
| 2 | .51 | .48 | .46 | .45 | .48 | .44 | .46 | .43 | .45 | .42 | .41 |
| 3 | .48 | .45 | .42 | .41 | .44 | .40 | .43 | .40 | .42 | .39 | .38 |
| 4 | .45 | .42 | .39 | .37 | .41 | .37 | .40 | .36 | .39 | .36 | .35 |
| 5 | .43 | .39 | .36 | .34 | .38 | .34 | .38 | .33 | .37 | .33 | .32 |
| 6 | .41 | .36 | .33 | .31 | .36 | .31 | .35 | .31 | .35 | .31 | .30 |
| 7 | .39 | .34 | .31 | .29 | .34 | .29 | .33 | .29 | .32 | .29 | .28 |
| 8 | .37 | .32 | .29 | .27 | .32 | .27 | .31 | .27 | .31 | .27 | .26 |
| 9 | .35 | .30 | .27 | .25 | .30 | .25 | .29 | .25 | .29 | .25 | .24 |
| 10 | .33 | .28 | .25 | .23 | .28 | .23 | .28 | .23 | .27 | .23 | .23 |

P626 One 26W Quad Tube lamp

Notes

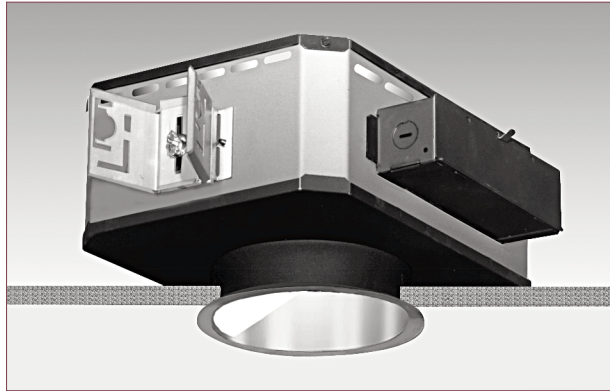
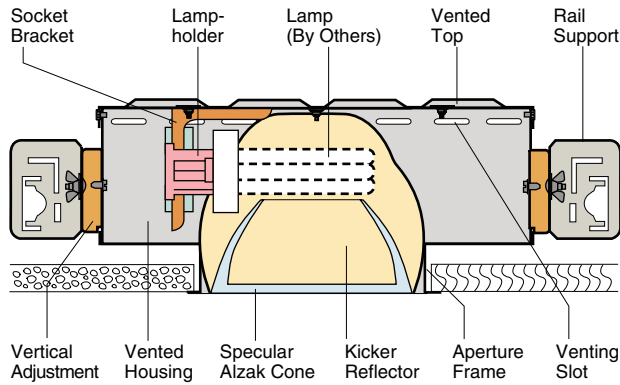
- Data on all charts calculated with a clear specular cone finish.
- Specular cone multipliers: Wheat x .88, Pewter x .78, Mocha x .77, Graphite x .75, Titanium x .75, Bronze x .69.
- Softglow® cone multipliers: Clear x .92, Gold x .79, Wheat x .72, Pewter x .68, Mocha x .70, Graphite x .68, Titanium x .68, Bronze x .61.
- Single unit Datachart pattern diameters are determined by the number of degrees from each side of nadir. Therefore a 15° diameter represents a total 30° pattern width at the work plane 30" above the floor. Footcandle values are at the edge of that diameter.
- Datachart spacing is rounded off to the nearest foot.
- Brightness data from the Average Luminance Method are inaccurate for small aperture downlights. They are theoretical calculations derived for large surfaces such as troffers. For a complete discussion refer to section Z brochure Z1.

Brightness

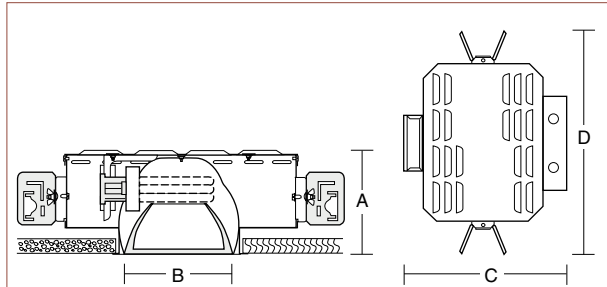
| Number | Lamps | 85° | 75° | 65° | 55° | 45° |
|--------|-------------------|-----|-----|-----|-----|------|
| P626 | One 26W Quad Tube | 2 | 13 | 20 | 135 | 8260 |

Data in footlamberts. Photometer readings, Maximum Brightness Method. See note 6.





Dimensions and Lamps



| Number | A Depth | B Aperture | C Width | D Length | Lamp |
|--------|-------------|-----------------|------------------|--------------|-----------------------|
| P953 | 6" 152mm | 5 7/8" 149mm | 13 1/2" 343mm | 19" 483mm | 26-32-42W Triple Tube |

P953

Wall Washer
One 26-32-42W Triple Tube Lamp
5 7/8" Conoid Aperture

Optics and Applications

A full circle kicker reflector directs a uniform wash light to adjacent walls. The pattern is free from spikes, striations or dropouts and features wide lateral distribution. The downlight component is uniform with a soft edge to blend with nearby units. Use in low to medium height ceilings.

Design Features

Construction allows easy access to all components. A steel housing protects the reflectors which are joined to assure predictable performance. Vented air flow design assures cool fixture temperature for optimal lamp performance. Maximum ceiling thickness 1 1/2". Ballast and lamp service from below.

Finish

A specular clear Alzak cone is standard. Optional colors and Softglow® finishes available. Housing and structural parts are phosphated for corrosion resistance, then painted optical matte black for control of stray light leaks.

Ballast

Fully electronic, microprocessor controlled with variable starting current for inrush protection to assure rated lamp life. Input voltage ranges from 120V through 277V. Operates 26W, 32W or 42W triple tube lamps interchangeably. Power factor .98, starting temperature 0° F (-18° C), THD < 10%. Pre-heat start < 1.0 second. End of lamp life protection. Rated for > 50,000 starts.

General

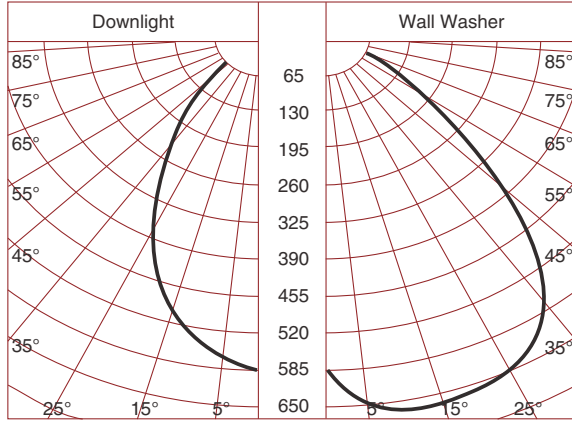
Fixtures are pre-wired, UL and C-UL listed for eight wire 75°C branch circuit wiring. Union made IBEW. Luminaire Efficiency Ratings (LER) do not apply to wall washers.

Accessories

- G Gold cone.
- H Mocha cone.
- P Graphite cone.
- T Titanium cone.
- W Wheat cone.
- Y Pewter cone.
- Z Bronze cone.
- S Softglow® finishes: add S before color letters. e.g. SW for Softglow® wheat cone, SC for Softglow® clear cone.
- DM Dimming ballast. Specify watts and volts.
- EM Emergency power includes integral charger light and test switch visible through aperture. Single lamp operation for 90 minutes. Specify volts.
- WRL Wattage restriction label, specify wattage.
- L Limited wall wash.
- D Double wall wash.
- C 250° corner wall wash.
- R2 26" support rails.
- R5 52" support rails.
- WT White trim flange.
- WHT White complete trim.
- V347 347 volt ballast.
- F Fuse.

P62 P953

Candlepower Distribution Curves

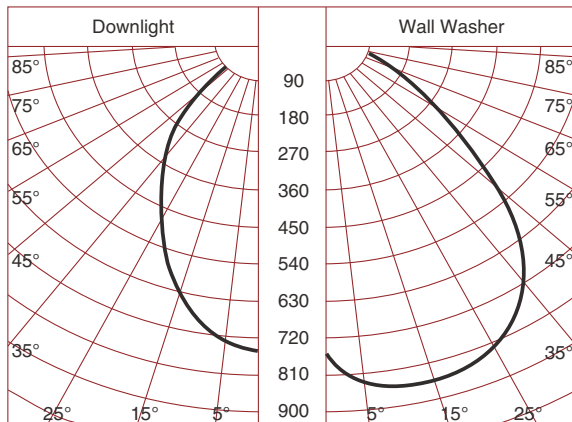


P953 One 32W Philips Triple Tube

Multiple Units Footcandles

| From Ceiling | 2' from wall | | 3' from wall | | | | 4' from wall | | | | | |
|--------------|--------------|-----|--------------|-----|------------|-----|--------------|-----|------------|-----|------------|-----|
| | 2' Centers | | 3' Centers | | 3' Centers | | 4' Centers | | 4' Centers | | 6' Centers | |
| | CL | Mid | CL | Mid | CL | Mid | CL | Mid | CL | Mid | CL | Mid |
| 1' | 40 | 39 | 31 | 24 | 13 | 13 | 11 | 9 | 6 | 5 | 5 | 3 |
| 2' | 55 | 55 | 42 | 34 | 20 | 20 | 16 | 14 | 10 | 10 | 8 | 6 |
| 3' | 51 | 51 | 34 | 33 | 25 | 25 | 20 | 17 | 12 | 12 | 9 | 7 |
| 4' | 37 | 37 | 25 | 24 | 25 | 24 | 19 | 18 | 14 | 14 | 10 | 8 |
| 5' | 26 | 26 | 17 | 17 | 21 | 21 | 16 | 15 | 14 | 14 | 10 | 9 |
| 6' | 19 | 19 | 13 | 12 | 16 | 16 | 13 | 12 | 13 | 13 | 9 | 9 |
| 7' | 14 | 14 | 9 | 9 | 13 | 12 | 10 | 10 | 11 | 11 | 8 | 7 |
| 8' | 11 | 11 | 7 | 7 | 10 | 10 | 8 | 8 | 9 | 9 | 6 | 6 |
| 10' | 7 | 7 | 4 | 4 | 6 | 6 | 5 | 5 | 6 | 6 | 4 | 4 |
| 12' | 5 | 5 | 3 | 3 | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 3 |

P953 One 32W Philips Triple Tube



P953 One 42W Philips Triple Tube

| From Ceiling | 2' from wall | | 3' from wall | | | | 4' from wall | | | | | |
|--------------|--------------|-----|--------------|-----|------------|-----|--------------|-----|------------|-----|------------|-----|
| | 2' Centers | | 3' Centers | | 3' Centers | | 4' Centers | | 4' Centers | | 6' Centers | |
| | CL | Mid | CL | Mid | CL | Mid | CL | Mid | CL | Mid | CL | Mid |
| 1' | 51 | 49 | 39 | 30 | 17 | 16 | 14 | 11 | 7 | 7 | 6 | 4 |
| 2' | 70 | 70 | 53 | 43 | 26 | 25 | 21 | 18 | 13 | 13 | 10 | 7 |
| 3' | 64 | 64 | 44 | 42 | 32 | 32 | 25 | 22 | 15 | 15 | 11 | 9 |
| 4' | 47 | 47 | 31 | 31 | 31 | 32 | 24 | 23 | 18 | 18 | 13 | 10 |
| 5' | 33 | 33 | 22 | 22 | 27 | 27 | 20 | 20 | 18 | 18 | 13 | 12 |
| 6' | 24 | 24 | 16 | 16 | 21 | 21 | 16 | 16 | 16 | 16 | 11 | 11 |
| 7' | 18 | 18 | 12 | 12 | 17 | 17 | 13 | 12 | 14 | 14 | 10 | 9 |
| 8' | 14 | 14 | 9 | 9 | 13 | 13 | 10 | 10 | 12 | 12 | 8 | 8 |
| 9' | 11 | 11 | 7 | 7 | 11 | 11 | 8 | 8 | 10 | 10 | 7 | 7 |
| 10' | 9 | 8 | 6 | 6 | 9 | 9 | 6 | 6 | 8 | 8 | 6 | 6 |

P953 One 42W Philips Triple Tube

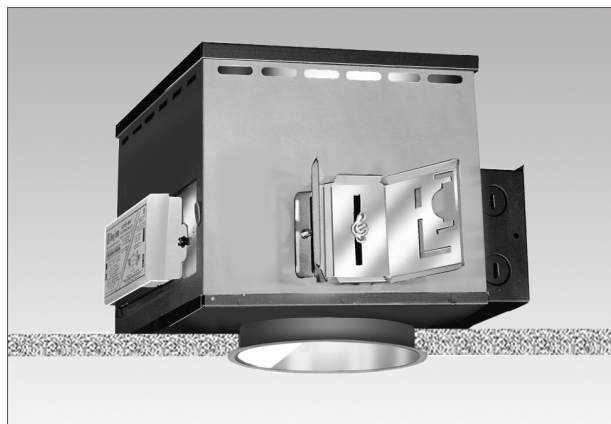
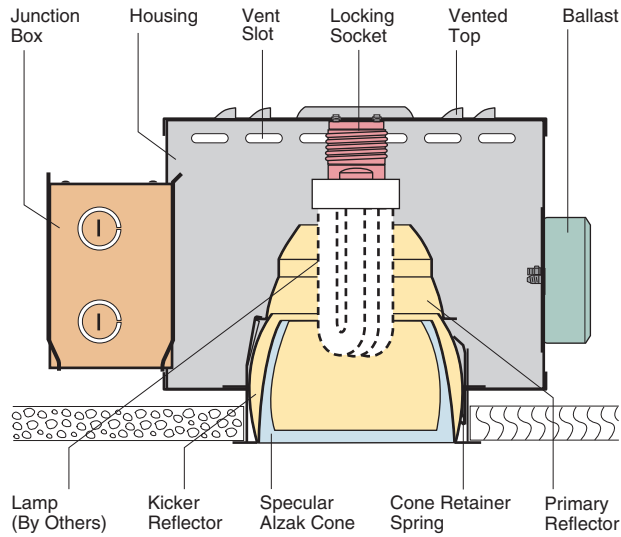
Notes

- 1 Data by IES methods. Compact fluorescent data vary due to lamp lumen differences, power input, burning position, ambient temperature and ballast characteristics. A modification factor should be applied.
- 2 Above data measure output of the wall washers only. No contribution from adjacent downlights or ceiling, floor or wall reflectances is included. Total illumination on the wall will increase with the contribution from other sources.
- 3 Data are cosine corrected to the plane of the wall. Uncorrected data are substantially higher and depend upon the angle of incidence to the wall which varies with the mounting distance from the wall.
- 4 Kurt Versen wall washers are designed to minimize hard shadow lines at the ceiling. Light intensity increases gradually to the maximum area, just above eye level. The field is uniform, devoid of hot spots, striations and spikes.
- 5 If colored cones are required, only the downlight cone will be tinted. The kicker reflector is always clear Alzak for maximum output and true color rendition.
- 6 Specular cone multipliers: Use for downlight and brightness data only: Gold x .91, Wheat x .87, Pewter x .81, Mocha x .81, Graphite x .78, Titanium x .78, Bronze x 75.
- 7 Softglow® cone multipliers: Use for downlight and brightness data only: Clear x .98, Wheat x .82, Mocha x .81, Pewter x .80, Graphite x .78, Titanium x .78, Bronze x .66.
- 8 Brightness data from the Average Luminance Method are inaccurate for small aperture downlights. They are theoretical calculations derived for large surfaces such as troffers. For a complete discussion refer to section Z brochure Z1.

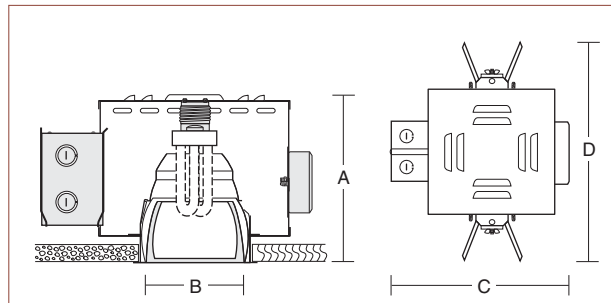
Brightness

| Number | Lamps | 85° | 75° | 65° | 55° | 45° |
|--------|-----------------------------|-----|-----|-----|------|-------|
| P953 | One 32W Philips Triple Tube | 6 | 14 | 29 | 1050 | 9318 |
| | One 32W Osram Triple Tube | 7 | 18 | 32 | 895 | 10000 |
| | One 42W Philips Triple Tube | 8 | 19 | 40 | 1413 | 12545 |
| | One 42W Osram Triple Tube | 9 | 25 | 44 | 1234 | 13794 |

Data in footlamberts. Photometer readings, Maximum Brightness Method. See note 8.



Dimensions and Lamps



| Number | A Depth | B Aperture | C Width | D Length | Lamps |
|--------|-----------------|-----------------|--------------|------------------|-------------------------|
| P919 | 7 1/4" 184mm | 4 1/8" 105mm | 12" 305mm | 14 1/4" 362mm | 18W Philips Triple Tube |

*Recess depth increases to 8 3/4" with EM and DM accessories.

P919

Wall Washer
One 18W Triple Tube Lamp
4 1/8" Conoid Aperture

Optics and Applications

Small apertures do not perform properly with radically different lamp shapes. Philips is recommended here for its photometric characteristics. A full circle kicker reflector directs a uniform wash light to the wall. The pattern is free from spikes, striations or dropouts and features wide lateral distribution. The downlight component has a soft edge to blend with nearby units. For low to medium height ceilings.

Design Features

Construction allows easy access to all components. A steel housing protects the reflectors which are joined to assure predictable performance. Efficient air flow design assures cool fixture temperature for optimal lamp performance. Maximum ceiling thickness 1". Ballast and lamp service from below.

Finish

A specular clear Alzak cone is standard. Optional colors and Softglow® finishes are available. The housing and all structural parts are phosphated for corrosion resistance before being painted optical matte black for control of stray light leaks.

Ballast

Fully electronic, microprocessor controlled with variable starting current for inrush protection to assure rated lamp life. Input voltage range from 120V through 277V. Power factor .98, starting temperature 0°F (-18°C), THD < 10%. Pre-heat start < 1.0 second. End of lamp life protection. Rated for > 50,000 starts.

General

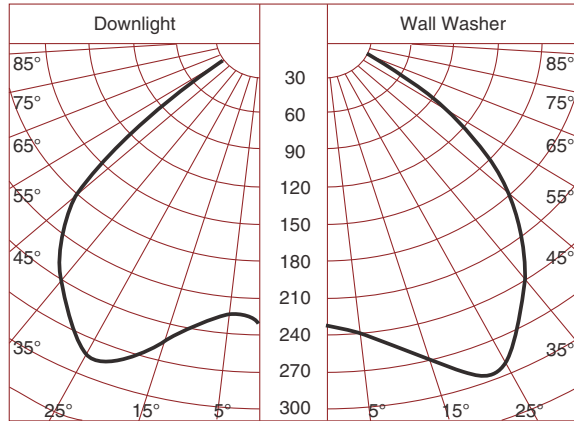
Fixtures are pre-wired, UL and C-UL listed for eight wire 75°C branch circuit wiring. Union made IBEW. Luminaire Efficiency Ratings (LER) do not apply to wall washers.

Accessories

- G Gold cone.
- H Mocha cone.
- P Graphite cone.
- T Titanium cone.
- W Wheat cone.
- Y Pewter cone.
- Z Bronze cone.
- R2 26" support rails.
- R5 52" support rails.
- WT White trim flange.
- WHT White complete trim.
- V347 347 volt ballast.
- F Fuse.
- S Softglow® finishes: add S before color letters. e.g. SW for Softglow® wheat cone, SC for Softglow® clear cone.
- DM Dimming ballast. Specify watts and volts.
- EM Emergency power includes integral charger light and test switch visible through aperture. Single lamp operation for 90 minutes. Specify volts.
- L Limited wall wash.
- D Double wall wash.
- C 250° corner wall wash.

P60 P919

Candlepower Distribution Curves



P919 One 18W Philips Triple Tube

Multiple Units Footcandles

| From Ceiling | 2' from wall | | 3' from wall | | | | 4' from wall | | | | | |
|--------------|--------------|-----|--------------|-----|------------|-----|--------------|-----|------------|-----|------------|-----|
| | 2' Centers | | 3' Centers | | 3' Centers | | 4' Centers | | 4' Centers | | 6' Centers | |
| | CL | Mid | CL | Mid | CL | Mid | CL | Mid | CL | Mid | CL | Mid |
| 1' | 15 | 13 | 12 | 8 | 4 | 4 | 3 | 2 | 2 | 1 | 1 | 1 |
| 2' | 25 | 26 | 18 | 17 | 9 | 9 | 8 | 6 | 4 | 3 | 3 | 2 |
| 3' | 22 | 22 | 15 | 15 | 11 | 12 | 9 | 8 | 6 | 6 | 4 | 3 |
| 4' | 17 | 17 | 11 | 11 | 11 | 11 | 8 | 8 | 6 | 7 | 5 | 4 |
| 5' | 12 | 12 | 8 | 8 | 9 | 9 | 7 | 7 | 6 | 7 | 4 | 4 |
| 6' | 9 | 9 | 6 | 6 | 8 | 8 | 6 | 6 | 6 | 6 | 4 | 4 |
| 7' | 7 | 7 | 5 | 4 | 6 | 6 | 5 | 5 | 5 | 5 | 3 | 3 |
| 8' | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 3 | 3 |
| 10' | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 3 | 4 | 3 | 2 | 2 |
| 12' | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 |

P919 One 18W Philips Triple Tube

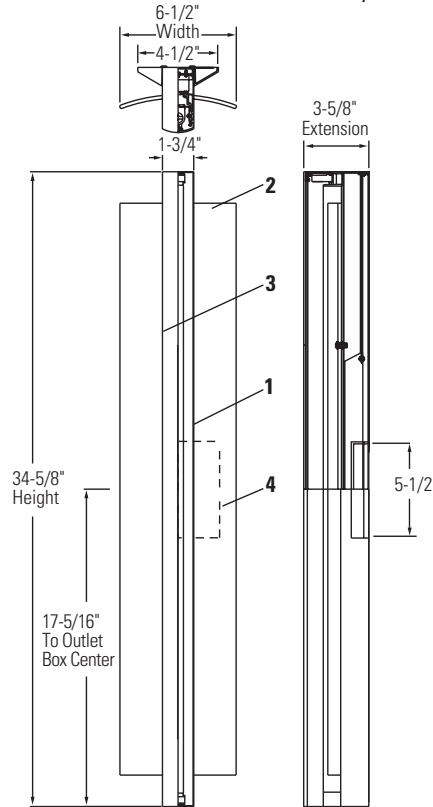
Notes

- 1 Data by IES methods. Compact fluorescent data vary due to lamp lumen differences, power input, burning position, ambient temperature and ballast characteristics. A modification factor should be applied.
- 2 Above data measure output of the wall washers only. No contribution from adjacent downlights or ceiling, floor or wall reflectances is included. Total illumination on the wall will increase with the contribution from other sources.
- 3 Data are cosine corrected to the plane of the wall. Uncorrected data would be substantially higher and depend upon the angle of incidence to the wall which varies with the mounting distance from the wall.
- 4 Kurt Versen wall washers are designed to minimize hard shadow lines at the ceiling. Light intensity increases gradually to the maximum area, just above eye level. The field is uniform, devoid of hot spots, striations and spikes.
- 5 If colored cones are required, only the downlight cone will be tinted. The kicker reflector is always clear Alzak for maximum output and true color rendition.
- 6 Specular cone multipliers: Gold x .91, Wheat x .89, Mocha x .81, Pewter x .80, Graphite x .78, Titanium x .78, Bronze x .75.
- 7 Softglow® cone multipliers: Clear x .98, Gold x .93, Wheat x .89, Mocha x .81, Pewter x .80, Graphite x .78, Titanium x .78, Bronze x .71.
- 8 Brightness data from the Average Luminance Method are inaccurate for small aperture downlights. They are theoretical calculations derived for large surfaces such as troffers. For a complete discussion refer to section Z brochure Z1.

Brightness

| Number | Lamps | 85° | 75° | 65° | 55° | 45° |
|--------|-----------------------------|-----|-----|-----|------|-------|
| P919 | One 18W Philips Triple Tube | 381 | 322 | 456 | 9060 | 12322 |

Data in footlamberts. Photometer readings, Maximum Brightness Method. See note 8.



Note: Luminaire can be ordered with or without diffusing shield. Order each separately. Can be mounted vertically or horizontally.

Fixture Ordering Information

| Catalog No. | Finish | Wattage | Voltage | Lamping |
|-------------|-------------------|---------|----------|----------------------------------|
| 48022ALU | Powder Coated | 21W | 120/277V | T-5 Miniature Bi-Pin Fluorescent |
| 48022AL39U | Metallic Aluminum | 39W HO | 120/277V | T-5 Miniature Bi-Pin Fluorescent |

Diffuser Ordering Information

| Catalog No. | Description | Dimensions |
|-------------|---|--------------------------------|
| 40875 | Translucent Etched Soda Lime Glass w/ Pencil Polished Edges | 31.25" L x 6.5" W x 5 mm Thick |
| 40915 | Extruded Opal Virgin Acrylic w/ Pencil Polished Edges | 31.25" L x 6.5" W x 5 mm Thick |

Features

- Housing:** Extruded and die-cast aluminum ballast and lamp chamber.
- Optional Diffuser/Reflector:** Curved etched glass or extruded opal virgin acrylic.
- Optics:** Internal white acrylic diffuser covers slit on front cover.
- J-Box Covers:** Die-cast split covers to enclose 4" octagonal J-Box (J-Box by others).

Mounting

Mounts directly to switch box or 4" octagonal J-Box. Octagonal box mounting requires use of "J-Box Covers" and "Support Plate" supplied standard.

Electrical

| Ballast | 21 W | 39W HO |
|-----------------------|----------------------------|-----------------------------------|
| (Electronic 120/277V) | | |
| Total Input Watts: | 25W | 39W |
| Max. Line Current: | 120V = 0.21 277V = 0.10 | 120V = 0.34 277V = 0.15 |
| Power Factor: | 120V = 0.98 277V = 0.95 | 120V = 0.98 0.98 = (120V/277V) |
| Ballast Factor: | 1.03 | 0.90 |
| THD: | 120V = <10% 277V = <15% | 120V = <10% 277V = <10% |
| Starting Temp: | 0°F / -18°C | 0°F / -18°C |

Finish

All painted parts utilized the powder coat process. Lightolier Metallic Aluminum Powder Coat Enamel.

Labels

cULus Listed. Suitable for Damp Locations.

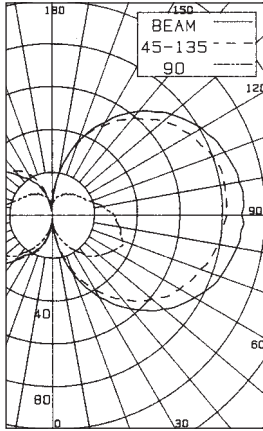
| Job Information | Type: |
|------------------|-------|
| Job Name: | |
| Cat. No.: | |
| Lamp(s): | |
| Notes: | |

Lightolier a Genlyte company www.lightolier.com
 631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710
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LIGHTOLIER®

Architectural Decorative Soli™ 48022ALU

CERTIFIED TEST REPORT NO. 2219FR
 COMPUTED BY LSI PROGRAM **TEST-LITE**
 LIGHTOLIER ARCHITECTURAL DECORATIVE LUMINAIRE SOLI
 CAT. NO. 48022ALU / 40875, ETCHED GLASS SHIELD
 1-21W PHILIPS T-5 LAMP. LUMEN RATING = 1900 LMS.
 UNIVERSAL BALLAST #B228PUNVC



| ZONE DEG. | CANDLEPOWER | | | | |
|-----------|-------------|------|----|------|----|
| | 90 | 67.5 | 45 | 22.5 | 90 |
| | CANDELAS | | | | |
| 0 | 2 | 2 | 2 | 2 | 2 |
| 5 | 4 | 3 | 4 | 5 | 5 |
| 15 | 9 | 10 | 19 | 22 | 21 |
| 25 | 15 | 22 | 34 | 38 | 37 |
| 35 | 21 | 31 | 46 | 50 | 51 |
| 45 | 27 | 40 | 57 | 60 | 63 |
| 55 | 31 | 47 | 66 | 69 | 73 |
| 65 | 35 | 53 | 72 | 76 | 81 |
| 75 | 33 | 58 | 77 | 80 | 86 |
| 85 | 30 | 63 | 80 | 83 | 89 |
| 95 | 26 | 65 | 82 | 84 | 90 |
| 115 | 17 | 65 | 72 | 79 | 84 |
| 125 | 15 | 60 | 63 | 73 | 77 |
| 135 | 14 | 53 | 54 | 65 | 68 |
| 145 | 12 | 44 | 43 | 57 | 57 |
| 155 | 10 | 35 | 29 | 45 | 44 |
| 165 | 9 | 22 | 21 | 31 | 29 |
| 175 | 6 | 10 | 12 | 13 | 13 |
| 180 | 5 | 5 | 5 | 5 | 5 |

Prepared For:
 Lightolier
 Fall River, MA
 Date: May 6, 2003

Tested according to IES procedures.
 Test distance exceeds five times the greatest luminous opening of luminaire.

COEFFICIENTS OF UTILIZATION
 % EFFECTIVE CEILING CAVITY REFLECTANCE

| | 80 | | | | | | 70 | | | | | | 50 | | | | | | 30 | | | | | | 10 | | | | | | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|-------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|----|------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|----|----|----|----|----|---|----|---|---|---|---|---|---|---|---|---|---|----|----|---|----|----|---|----|---|---|---|---|---|---|---|---|---|---|----|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | | | 30 | | | 10 | | | 50 | | | 30 | | | 10 | | | 50 | | | 30 | | | 10 | | | 50 | | | 30 | | | 10 | | | 50 | | | 30 | | | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | % WALL REFLECTION | | | | | | | | | | | | | | | | | | 20% FLOOR CAVITY REFLECTANCE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 31 | 31 | 31 | 28 | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 16 | 14 | 1 | 24 | 23 | 21 | 22 | 21 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 2 | 20 | 18 | 16 | 19 | 17 | 15 | 15 | 14 | 12 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 3 | 17 | 15 | 13 | 16 | 14 | 12 | 13 | 11 | 10 | 10 | 9 | 8 | 8 | 7 | 6 | 4 | 4 | 15 | 12 | 10 | 14 | 11 | 9 | 11 | 9 | 8 | 9 | 7 | 6 | 7 | 5 | 4 | 3 | 5 | 13 | 11 | 8 | 12 | 10 | 8 | 10 | 8 | 6 | 8 | 6 | 5 | 6 | 5 | 4 | 3 | 6 | 12 | 9 | 7 | 11 | 8 | 7 | 9 | 7 | 5 | 7 | 5 | 4 | 5 | 4 | 3 | 2 | 7 | 10 | 8 | 6 | 10 | 7 | 6 | 8 | 6 | 5 | 6 | 5 | 4 | 5 | 3 | 3 | 2 | 8 | 9 | 7 | 5 | 9 | 6 | 5 | 7 | 5 | 4 | 6 | 4 | 3 | 4 | 3 | 2 | 1 | 9 | 9 | 6 | 5 | 8 | 6 | 4 | 6 | 5 | 3 | 5 | 4 | 3 | 4 | 3 | 2 | 1 | 10 | 8 | 5 | 4 | 7 | 5 | 4 | 6 | 4 | 3 | 5 | 3 | 2 | 4 | 2 | 2 | 1 |

DETERMINED IN ACCORDANCE WITH CURRENT IES PUBLISHED PROCEDURES
 20% FLOOR CAVITY REFLECTANCE

Multiply Calculated footcandles by 1.6 for 39W HO Lamp.

| Zone | DISTRIBUTION | | |
|--------|--------------|--------|-------------|
| | Lumens | % Lamp | % Luminaire |
| 0-30 | 15 | .82 | 2.87 |
| 0-40 | 35 | 1.87 | 6.56 |
| 0-60 | 106 | 5.59 | 19.61 |
| 0-90 | 267 | 14.07 | 49.31 |
| 40-90 | 231 | 12.20 | 42.75 |
| 60-90 | 161 | 8.47 | 29.70 |
| 90-180 | 274 | 14.46 | 50.69 |
| 0-180 | 542 | 28.53 | 100.00 |

** EFFICIENCY = 28.5% **

Job Information **Type:**

Lightolier a Genlyte company www.lightolier.com
 631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710
 We reserve the right to change details of design, materials and finish.
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LIGHTOLIER®

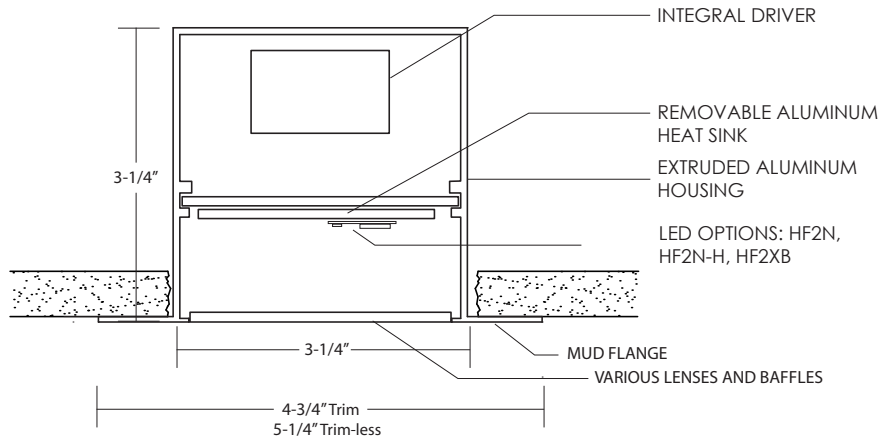
JAKE -325 LED



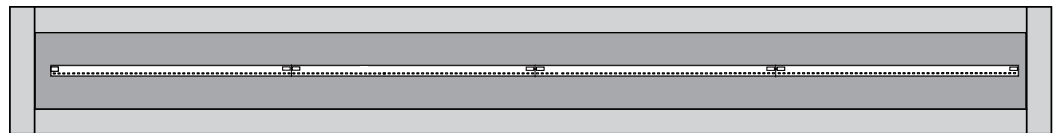
3" OPENING RECESS FIXTURES

RECESSED TRIM/TRIMLESS

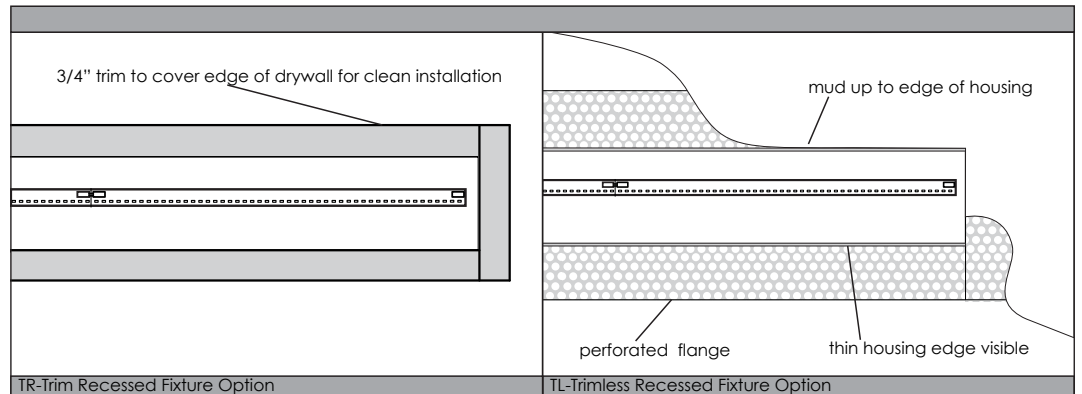
- extruded aluminum housing
- recessed housing with trim for clean aesthetic, and ease of installation
- HF2N, HF2N-H, and HF2XB light engines available. *see light engine page for specs.
- Driver are integral in fixture, dimming available.
- variety of lensing options- custom colors and materials available- consult factory
- seamless continuous run end to end board connections available.
- UL and C-UL listed for Dry and Damp locations



STAND ALONE FIXTURE OPTIONS



STAND ALONE



FIXTURE SPECIFICATIONS

| JAKE-325 | | | | | | | | | |
|---|--|--|---|--|--|---|------------------------------|--|---|
| Model JAKE-325 Jake 3.25" recessed fixtures | Finish TR- Trim TL- Trim-less | # of boards in cross section 1- 1 board 2- 2 boards | Light Engine HF2N - Linear LED 10" or 4" boards, 102 emitters or 42 emitters HF2N-H - Linear LED 10" or 4" boards, 54 emitters or 24 emitters HF2XB-S4 - Linear LED 11.5" board, 4 emitters | Driver EB - electronic driver DIM_1 - 1% dimming module* DIM_10 -10% dimming driver* | Color 30 - 3000k 35 - 3500k 40 - 4000k | Nominal Length LED Fixture can be specified in 10" increments CR_** - Continuous Run **Specify length in nominal feet | Voltage 120 277 | Finish Anodized: SC - Satin Clear (Standard) CU - Custom* Powder Coated: FB - Flat Black*** MW - Matte White*** CU - Custom* | Lens/ Louver SIW - Satin Ice White SIC - Satin Ice Clear NL - No lens **CU - Custom Louver Options PLSS - Parabolic Louver Semi-Specular BLSS - Blade Louver Semi-Specular |

**FOR FOR ANY CUSTOM OPTION, PLEASE CONTACT FACTORY - EXPECT LONGER LEAD TIMES

***NON- STOCKED ITEMS - EXPECT LONGER LEAD TIMES

-PART NUMBER EXAMPLE: JAKE325-TR-1-HF2N-EB-30-40-120-SC-SIW

Job Information

Type: _____

Job Name: _____

Location: _____

BIRCHWOOD LIGHTING

714.550.7118 • fax 714.550.7151 • www.BirchwoodLighting.com

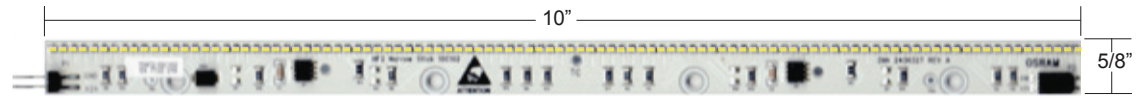
NOTE: Specifications and dimensions are subject to change without notice.



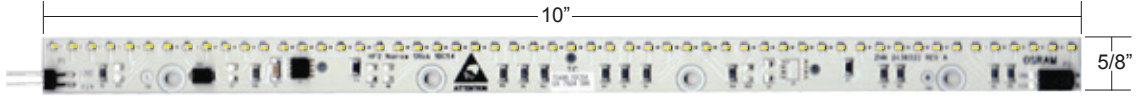
JAKE-325-LED



HF2XB-S4



HF2N *** 4" board also available



HF2N-H (half populated) *** 4" board also available

LED LIGHT ENGINE SPECS

LED OPTIONS

- Light engines available:
 - HF2N - 102 emitters on 10" - 10 watts/ft. 540 lumens/ft.
 - HF2N-H - 54 emitters on 10" 5 watts/ft. . 270 lumens/ft.
 - HF2XB-S4 - 4 emitters on 11.5" 3.9 watts/ft. 225 lumens/ft.
- please consult factory for other options
- dimmable by pulse width modulation *Contact Factory
- continuous run with several boards
- remote driver required: *see driver housing page *consult factory for driver options
- 5 year warranty on LED board and driver combination
- UL and C-UL listed for Dry and Damp locations

*terms and conditions apply, must be installed in suitable location, boards not to be used in alternate fixtures.

HF2N

- Narrow 5/8" w board comprized with closely packed small LEDs
- High Lumen LED emitters with rated service life to 50,000 hours at 65 degrees Celsius.
- HF2N modules come in 10" and 4" sections with 102 emitters on the 10" and 42 emitters on the 4" section near continous light. 10 watts/ft. yielding 540 lumens/ft., which is 54 lumens/watt (lumen/ft. and lumens/watt based on 3000K color temp)
- Available in 3000K, 3500K and 4000K
- 120 degree beam angle
- CRI 85
- Dimmable by pulse width modulation

HF2N-H (half populated)

- Narrow 5/8" w board comprized with closely packed small LEDs
- High Lumen LED emitters with rated service life to 50,000 hours at 65 degrees Celsius.
- HF2N-H modules is half populated which in turn uses half the wattage and the operating temp is less than the full population
- HF2N-H modules come in 10" and 4" sections with 54 emitters on the 10" and 24 emitters on the 4" section near continuous light. 5 watts/ft. yielding 270 lumens/ft., which is 54 lumens/watt (lumen/ft. and lumens/watt based on 3000K color temp)
- Available in 3000K, 3500K and 4000K
- 120 degree beam angle
- CRI 85
- Dimmable by pulse width modulation

HF2XB-S4

- High Lumen LED emitters with rated service life to 50,000 hours at 40 degrees Celsius.
- HF2XB-S4 modules come in 11.5" lengths with 4 emitters per module 3.9 watts/ft. yielding 225 lumens/ft., which is 58 lumens/watt (lumen/ft. and lumens/watt based on 3000K color temp)
- Available in 3000K, 3500K and 4100K, and 5700K
- 90 degree beam angle
- HF2XB-S4 modules run on 24VDC power
- CRI 85
- Dimmable by pulse width modulation

Job Information

Type: _____

Job Name: _____

Location: _____

BIRCHWOOD LIGHTING

714.550.7118 • fax 714.550.7151 • www.BirchwoodLighting.com

NOTE: Specifications and dimensions are subject to change without notice.



OPT-LED

DRIVER HOUSINGS

REMOTE DRIVER HOUSINGS

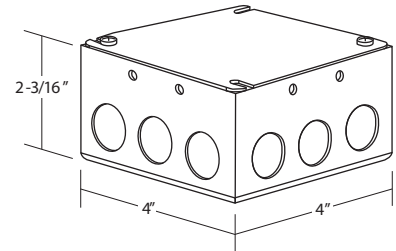
- used for remote power supplies
- formed aluminum construction
- standard finish is mill aluminum to provide excellent heat dissipation
- custom powder coat finishes are available for visible housings (consult factory)
- standard sizes shown, custom sizes are available
- driver(s) and housing(s) dependent upon run length
- all models feature several conveniently located trade size knock-outs (K.O.'s)
- consult factory for recommended maximum remote mounting distance
- UL and C-UL Listed for Dry Locations

STANDARD HOUSINGS

BB04C

- DIMENSIONS: 4" x 4" x 2-3/16"
- Used for 20w Drivers, 120V only
 - HF2N - 2' fixtures
 - HF2N-H - 4' fixtures
 - HF2XB-S4 - 5' fixtures

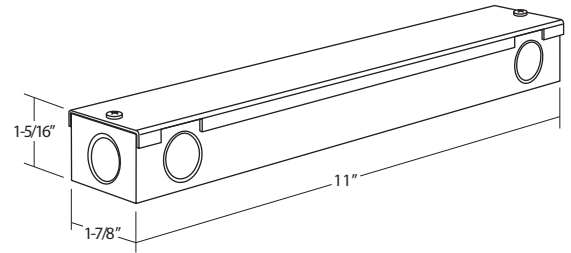
NOTE: Contact Factory about Driver Housings to be sent out prior to electrical rough-in.



BB11D

- DIMENSIONS: 11" x 1-7/8" x 1-5/16"
- Used for 75w Drivers, 120-277V
 - HF2N - 7' fixtures
 - HF2N-H - 14' fixture runs
 - HF2XB-S4 - 20' fixture runs

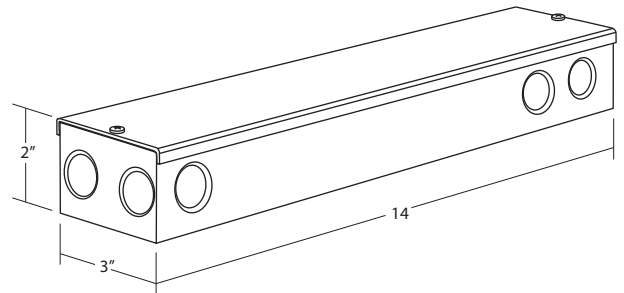
NOTE: Contact Factory about Driver Housings to be sent out prior to electrical rough-in.



BB14B

- DIMENSIONS: 14"(L) x 3" x 2"
- Used for 96w Drivers, 120-277V
 - HF2N - 9' fixture run
 - HF2N-H - 19' fixture run
 - HF2XB-S4 - 25' fixture run

NOTE: Contact Factory about Driver Housings to be sent out prior to electrical rough-in.

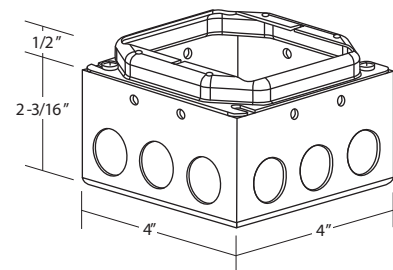


SPECIAL ORDER HOUSING

BB04C-MR

- DIMENSIONS: 4" x 4" x 2-3/16" includes 1/2" mud ring
- *consult factory for other options
- Used for 20w Drivers, 120V only
 - HF2N - 2' fixtures
 - HF2N-H - 4' fixtures
 - HF2XB-S4 - 5' fixtures

NOTE: Contact Factory about Driver Housings to be sent out prior to electrical rough-in.



GENERAL NOTES:

- The standard Driver Housing is mill aluminum (MA) finish.
- Please contact factory for custom housing sizes and/or color
- Contact factory with any ballast housing questions

Job Information

Type: _____

Job Name: _____

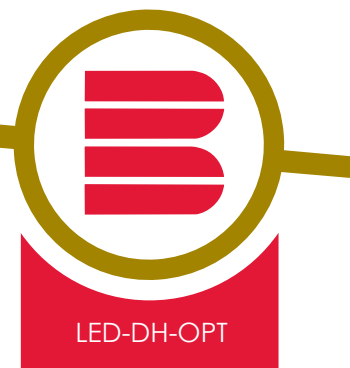
Location: _____

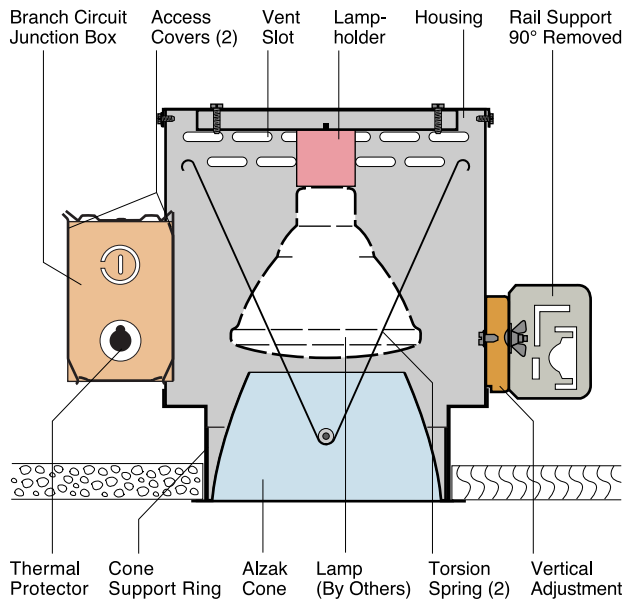
0110

BIRCHWOOD LIGHTING

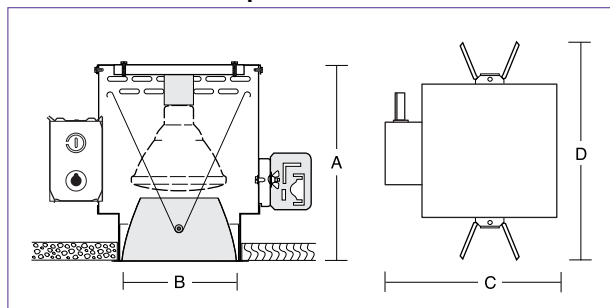
714.550.7118 ♦ fax 714.550.7151 ♦ www.BirchwoodLighting.com

NOTE: Specifications and dimensions are subject to change without notice.





Dimensions and Lamps



| Number | A Depth | B Aperture | C Width | D Length | Lamps |
|--------|------------------|-----------------|--------------|------------------|--------------------------------|
| C7301 | 8 1/2" 216mm | 5 7/8" 149mm | 11" 279mm | 14 1/4" 362mm | 50-75W PAR-30S |
| C7302 | 10 3/4" 273mm | 5 7/8" 149mm | 11" 279mm | 14 1/4" 362mm | 45-150W PAR-38 250W PAR-38* |

*Requires factory modification. To specify add -250 to catalog number, e.g. C7302-250. Fixture becomes dedicated 250W model. Contact factory for photometry.

**C7301
C7302**

**PAR Lamps to 250W
5 7/8" Conoid Apertures**

Optics and Applications

Distribution patterns and spacing to mounting height ratios change with the lamps accommodated by these units. Variations from narrow to broad patterns are available. See back of page for specific performance information.

Design Features

The parabolic cones gather and redirect spill light to the workplace. Performance is efficient with very low brightness from normal viewing angles. Sturdy steel housings protect and position lamps and reflectors. Maximum ceiling thickness 2". Top or bottom service.

Finish

Specular clear Alzak cones are standard. Optional colors and Softglow® finishes are available. Housings and structural parts are painted optical matte black to suppress stray light leaks. Steel parts are phosphate conditioned for corrosion resistance before painting.

General

Fixtures are pre-wired and thermally protected, UL and C-UL listed for eight wire 75°C branch circuit wiring. Union made IBEW. Luminaire Efficiency Ratings (LER) do not apply to fixtures using reflector type lamps.

Accessories

- B Black cone.
- G Gold cone.
- H Mocha cone.
- P Graphite cone.
- T Titanium cone.
- W Wheat cone.
- Y Pewter cone.
- Z Bronze cone.
- S Softglow® finishes: add S before color letters. e.g. SW for Softglow® wheat cone, SC for Softglow® clear cone.
- R2 26" support rails.
- R5 52" support rails.
- WT White trim flange.
- WHT White complete trim.
- HL Hexcell louver*.
- LL Linear lens*.
- LP Large prism lens*.
- MP Micro prism lens*.

FF30-2 Accessory holder for PAR-30. Holds two accessories.
 FF38-1 Accessory holder for PAR-38. Holds one accessory.
 WRL Wattage restriction label, specify wattage.

For color filters, pattern control lenses, light block screens, UV filters and other accessories, contact the factory.

*Requires accessory holder.

Brightness

| Number | Lamps | 85° | 75° | 65° | 55° | 45° |
|--------|-------------------|-----|-----|-----|-----|-----|
| C7301 | 50W PAR-30 Flood | 0 | 1 | 2 | 3 | 240 |
| | 75W PAR-30 Flood | 1 | 1 | 2 | 5 | 340 |
| C7302 | 45W PAR-38 Flood | 1 | 2 | 4 | 48 | 160 |
| | 90W PAR-38 Flood | 1 | 5 | 6 | 10 | 392 |
| | 150W PAR-38 Flood | 2 | 10 | 13 | 21 | 816 |

Data in footlamberts. Photometer readings, Maximum Brightness Method.

C6 C7301 C7302

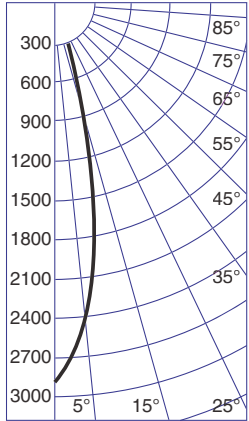
Performance Datachart

| Single Unit Initial Footcandles, 30" Work Plane | | | | | | Ceiling to Floor | Multiple Units Initial Footcandles, 30" Work Plane | | | |
|---|-----|------|-----|------|-----|------------------|--|-------|-------|-------|
| C7301 50W PAR-30/CAP/NFL Read Top Data | | | | | | 8' | Ceiling 80% Walls 50% Floor 20% | | | |
| C7301 75W PAR-30/CAP/NFL Read Bottom Data | | | | | | | Spacing is Maximum Over Work Plane | | | |
| Nadir | 10° | | 15° | | 20° | | Spacing | RCR 1 | RCR 3 | RCR 8 |
| FC | FC | Diam | FC | Diam | FC | Diam | | | | |
| 98 | 51 | 2' | 27 | 3' | 10 | 4' | 2' | 155 | 144 | 124 |
| 152 | 79 | 2' | 43 | 3' | 15 | 4' | 2' | 241 | 223 | 193 |
| 70 | 36 | 2' | 20 | 3' | 7 | 5' | 2' | 111 | 103 | 89 |
| 109 | 56 | 2' | 30 | 3' | 11 | 5' | 2' | 173 | 159 | 138 |
| 53 | 27 | 3' | 15 | 4' | 5 | 5' | 3' | 84 | 77 | 67 |
| 82 | 42 | 3' | 23 | 4' | 8 | 5' | 3' | 130 | 120 | 104 |
| 33 | 17 | 3' | 9 | 5' | 3 | 7' | 3' | 52 | 48 | 42 |
| 51 | 26 | 3' | 14 | 5' | 5 | 7' | 3' | 81 | 75 | 65 |
| 22 | 12 | 4' | 6 | 6' | 2 | 8' | 4' | 36 | 33 | 28 |
| 35 | 18 | 4' | 10 | 6' | 4 | 8' | 4' | 55 | 51 | 44 |

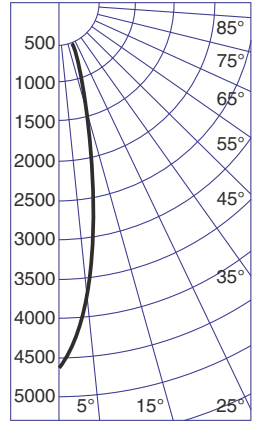
| Single Unit Initial Footcandles, 30" Work Plane | | | | | | Ceiling to Floor | Multiple Units Initial Footcandles, 30" Work Plane | | | |
|---|-----|------|-----|------|-----|------------------|--|-------|-------|-------|
| C7302 90W PAR-38/CAP/FL Read Top Data | | | | | | 10' | Ceiling 80% Walls 50% Floor 20% | | | |
| C7302 150W PAR-38/CAP/FL Read Bottom Data | | | | | | | Spacing is Maximum Over Work Plane | | | |
| Nadir | 10° | | 15° | | 20° | | Spacing | RCR 1 | RCR 3 | RCR 8 |
| FC | FC | Diam | FC | Diam | FC | Diam | | | | |
| 70 | 55 | 3' | 27 | 4' | 9 | 5' | 4' | 85 | 78 | 67 |
| 137 | 108 | 3' | 53 | 4' | 18 | 5' | 4' | 168 | 154 | 131 |
| 44 | 34 | 3' | 17 | 5' | 6 | 7' | 5' | 53 | 48 | 42 |
| 86 | 67 | 3' | 33 | 5' | 11 | 7' | 5' | 105 | 96 | 82 |
| 30 | 23 | 4' | 11 | 6' | 4 | 8' | 6' | 36 | 33 | 28 |
| 58 | 46 | 4' | 23 | 6' | 8 | 8' | 6' | 71 | 66 | 56 |
| 22 | 17 | 5' | 8 | 7' | 3 | 10' | 6' | 26 | 24 | 21 |
| 42 | 33 | 5' | 16 | 7' | 6 | 10' | 6' | 52 | 48 | 40 |
| 13 | 10 | 6' | 5 | 9' | 2 | 13' | 8' | 16 | 14 | 12 |
| 25 | 20 | 6' | 10 | 9' | 3 | 13' | 8' | 31 | 28 | 24 |

Colored cone multipliers: Gold x .98, Wheat x .97, Pewter x .95, Mocha x .95, Graphite x .92, Titanium x .92, Bronze x .89, Black x .80.

Candlepower Distribution



C7301 50W PAR-30/CAP/NFL
Eff. 89% S/M .36



C7301 75W PAR-30/CAP/NFL
Eff. 89% S/M .36

Candelas

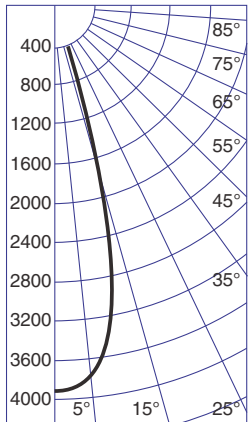
| ° | 50W | 75W |
|----|------|------|
| | 580* | 900* |
| 0 | 2971 | 4606 |
| 5 | 2456 | 3818 |
| 10 | 1601 | 2490 |
| 15 | 921 | 1431 |
| 20 | 365 | 560 |
| 25 | 83 | 124 |
| 30 | 24 | 41 |
| 35 | 8 | 20 |
| 40 | 0 | 0 |
| 45 | 0 | 0 |
| 50 | 0 | 0 |
| 55 | 0 | 0 |
| 60 | 0 | 0 |
| 65 | 0 | 0 |
| 70 | 0 | 0 |
| 75 | 0 | 0 |
| 80 | 0 | 0 |
| 85 | 0 | 0 |
| 90 | 0 | 0 |

° Vertical Angles
* Initial Lamp Lumens

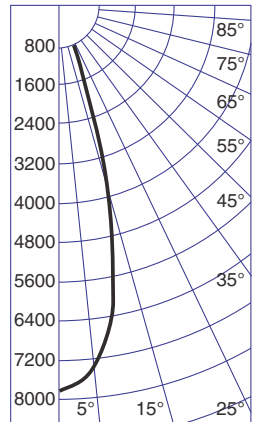
Coefficients of Utilization

| Ceiling | 80% | | | | 70% | | 50% | | 30% | | 0 |
|---------|---|------|------|------|------|------|-----|-----|-----|-----|-----|
| | 70 | 50 | 30 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 0 |
| Wall % | Zonal Cavity Method - Floor Reflectance 20% | | | | | | | | | | |
| RCR | Zonal Cavity Method - Floor Reflectance 20% | | | | | | | | | | |
| 1 | 1.07 | 1.05 | 1.03 | 1.02 | 1.03 | 1.00 | .99 | .97 | .96 | .94 | .90 |
| 2 | 1.04 | 1.01 | .98 | .96 | .99 | .95 | .96 | .93 | .94 | .91 | .88 |
| 3 | 1.01 | .97 | .94 | .92 | .96 | .91 | .94 | .90 | .92 | .88 | .86 |
| 4 | .98 | .94 | .91 | .88 | .93 | .88 | .91 | .87 | .89 | .86 | .84 |
| 5 | .96 | .91 | .88 | .85 | .90 | .85 | .89 | .84 | .87 | .83 | .82 |
| 6 | .94 | .89 | .85 | .83 | .88 | .82 | .87 | .82 | .86 | .81 | .80 |
| 7 | .91 | .86 | .83 | .80 | .86 | .80 | .85 | .80 | .84 | .79 | .78 |
| 8 | .89 | .84 | .81 | .78 | .84 | .78 | .83 | .78 | .82 | .78 | .77 |
| 9 | .87 | .82 | .79 | .77 | .82 | .76 | .81 | .76 | .80 | .76 | .75 |
| 10 | .86 | .80 | .77 | .75 | .80 | .75 | .79 | .75 | .79 | .74 | .74 |

C7301 50W PAR-30/CAP/NFL
C7301 75W PAR-30/CAP/NFL



C7302 90W PAR-38/CAP/FL
Eff. 80% S/M .48



C7302 150W PAR-38/CAP/FL
Eff. 76% S/M .48

| ° | 90W | 150W |
|----|-------|-------|
| | 1200* | 2500* |
| 0 | 3930 | 7728 |
| 5 | 3832 | 7536 |
| 10 | 3219 | 6336 |
| 15 | 1679 | 3312 |
| 20 | 632 | 1248 |
| 25 | 257 | 504 |
| 30 | 59 | 120 |
| 35 | 32 | 72 |
| 40 | 0 | 24 |
| 45 | 0 | 0 |
| 50 | 0 | 0 |
| 55 | 0 | 0 |
| 60 | 0 | 0 |
| 65 | 0 | 0 |
| 70 | 0 | 0 |
| 75 | 0 | 0 |
| 80 | 0 | 0 |
| 85 | 0 | 0 |
| 90 | 0 | 0 |

° Vertical Angles
* Initial Lamp Lumens

| Ceiling | 80% | | | | 70% | | 50% | | 30% | | 0 |
|---------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 70 | 50 | 30 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 0 |
| Wall % | Zonal Cavity Method - Floor Reflectance 20% | | | | | | | | | | |
| RCR | Zonal Cavity Method - Floor Reflectance 20% | | | | | | | | | | |
| 1 | .94 | .92 | .91 | .89 | .90 | .88 | .87 | .85 | .84 | .83 | .79 |
| 2 | .91 | .88 | .86 | .84 | .87 | .83 | .84 | .81 | .82 | .79 | .76 |
| 3 | .88 | .84 | .82 | .79 | .83 | .79 | .81 | .78 | .80 | .76 | .74 |
| 4 | .86 | .81 | .78 | .76 | .81 | .76 | .79 | .75 | .77 | .74 | .72 |
| 5 | .83 | .79 | .75 | .73 | .78 | .73 | .77 | .72 | .75 | .72 | .70 |
| 6 | .81 | .76 | .73 | .71 | .76 | .70 | .75 | .70 | .74 | .70 | .68 |
| 7 | .79 | .74 | .71 | .68 | .73 | .68 | .73 | .68 | .72 | .68 | .67 |
| 8 | .77 | .72 | .69 | .66 | .71 | .66 | .71 | .66 | .70 | .66 | .65 |
| 9 | .75 | .70 | .67 | .65 | .70 | .65 | .69 | .64 | .68 | .64 | .63 |
| 10 | .73 | .68 | .65 | .63 | .68 | .63 | .67 | .63 | .67 | .63 | .62 |

C7302 90W PAR-38/CAP/FL
C7302 150W PAR-38/CAP/FL x .95

Tetra[®] Contour

LED ARCHITECTURAL SERIES



Tetra Contour is comprised of a flexible LED light engine and a rigid, optically diffused light guide that can be heat formed to fit a variety of architectural needs. With a variety of colors to choose from, designers can mix-n-match components to create bold designs and attractive accent lighting without the typical worries of working with fragile neon glass.

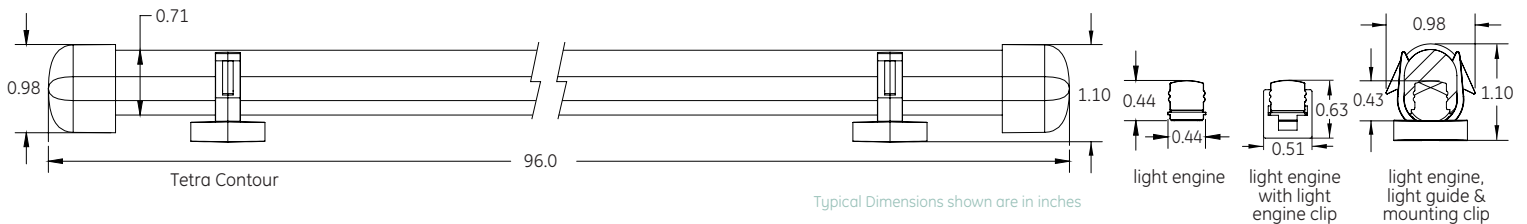
Applications

Tetra Contour is ideal for border lighting, interior art, cove and accent lighting.

Features & Benefits

- Up to 40% more energy efficient than neon
- Low-voltage 24VDC system
- Dimmable with GE 0-10V Dimming Driver or GE Dimming Module and compatible dimming controller
- Contains no lead, mercury or glass. RoHS compliant
- Long rated life of 50,000 hours
- Multiple ANSI bin color temperatures: red, green, blue, white & warm white
- Light guide colors: red, green, blue, white & clear

a product of
ecomaginationSM



Performance Data

| Product Code | Description Code | Color | Wavelength/Color Temp | Viewing Angle (light engine) | Viewing Angle (light engine w/ light guide) | Lumens ft/m (light engine) | Lumens ft/m (light engine w/ light guide) | Watts ft/m (light engine strip) | Watts ft/m (system) |
|--------------|------------------|-------|-----------------------|------------------------------|---|----------------------------|---|---------------------------------|---------------------|
| 75481 | GERDXNLE1-A | Red | 625nm | 110 | 330 | 59/194 | 47/154 | 3.24/10.63 | 3.81/12.50 |
| 75484 | GEGLXNLE1-A | Green | 532nm | 110 | 330 | 101/331 | 55/180 | 2.88/9.45 | 3.39/11.12 |
| 75485 | GEBLXNLE1-A | Blue | 467nm | 110 | 330 | 23/75 | 19/162 | 2.88/9.45 | 3.39/11.12 |
| 75487 | GEWWXNLE1-27K-A | White | 2700K | 110 | 330 | 107/351 | 70/230 | 2.88/9.45 | 3.39/11.12 |
| 75488 | GEWWXNLE1-30K-A | White | 3000K | 110 | 330 | 117/384 | 76/249 | 2.88/9.45 | 3.39/11.12 |
| 75489 | GEWWXNLE1-35K-A | White | 3500K | 110 | 330 | 125/410 | 81/266 | 2.88/9.45 | 3.39/11.12 |
| 75490 | GEWWXNLE1-40K-A | White | 4000K | 110 | 330 | 131/430 | 85/279 | 2.88/9.45 | 3.39/11.12 |
| 75493 | GEWHXNLE1-50K-A | White | 5000K | 110 | 330 | 156/512 | 101/331 | 2.88/9.45 | 3.39/11.12 |
| 75486 | GEWHXNLE1-65K-A | White | 6500K | 110 | 330 | 144/472 | 94/308 | 2.88/9.45 | 3.39/11.12 |

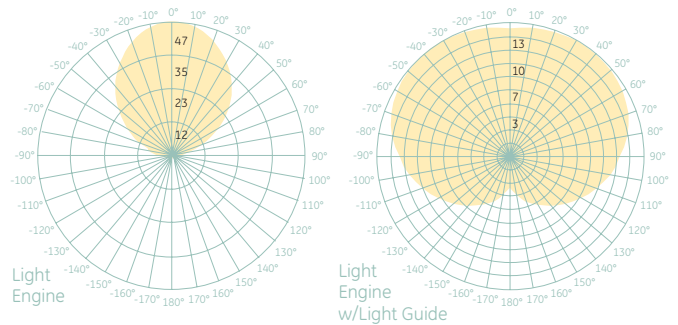
Lumen values are typical. Allow +/- 15% for binning tolerance.

Accessories

| Product Code | Description Code | Product Description | Quantity |
|--------------|------------------|--|----------------------|
| 75514 | 9409 | 18 AWG Supply Wire (0.82 mm ²) | 500 ft. (152.4 m)/PK |
| 75494 | GEXNWB2 | Weather Box (Outdoor Use Only) | 20/PK |
| 75498 | GEXNMCAC | Light Engine Mounting Clip | 20/PK |
| 75520 | GEXNMC15 | Light Guide Mounting Clip | 50/PK |
| 75537 | GEXNBA | 16 in. Silicone Bend-Aid (Reuseable) | 12/PK |
| 75612 | GEDM1-A | Tetra Dimming Module (0-10V) | 1/EA |

For a complete list of accessories including Light Guides, refer to the Tetra Contour Component Guide

Light Output



Candela (Cd) measurements taken at 6500K
IES files can be downloaded at www.gelightingsolutions.com

Technical Specifications

| Specification Item | Specification |
|---------------------------------|---|
| Module Dimensions | 0.44 in. x 0.44 in. x 16.25 in. (10 mm x 10 mm x 413 mm) |
| Length of Light Engine | 8 ft. (2.44 m) |
| Light Engine Packaging Quantity | Red only - 12/PK, All other colors - 6/PK |
| GE LED Drivers | 74917 (GE020/G/V24T1-B), 74915 (GE080/G/V24T1-A), 74916 (GE100/MV/V24T1-A), 62189 (GE180/MV/V24T1-C) & 79045 (GE080/MV/D24T1-A), 0-10V dimming |
| Operating Voltage | 24 VDC |
| Minimum Loading | 74917, 74915, 74916, 62189 & 79045: 8 in. (0.20 m) |
| Maximum Loading | 74917: 6 ft. (1.83 m) 74915 & 79045: 24 ft. (7.32 m) 74916: 30 ft. (9.14 m) 62189: 27 ft. (8.23 m) per Bank/54 ft. (16.46 m) per Driver |
| Remote Mounting | Standard length of 1-30 ft. (0.3-9.14m) with 18AWG (0.82mm ²) supply wire; for greater lengths refer to the installation instructions. |
| Ambient Temperature | -40°C to +55°C |
| Limited Warranty | 5 years |
| IP Rating | Light Engine IP54: Dry or damp location rated; Light Engine and Light Guide IP66: Dry, damp or wet location rated |

System Certifications



GE Lighting Solutions • 1-888-MY-GE-LED • www.gelightingsolutions.com
1-888-69-43-533

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Photograph courtesy of Blake Marvin-HKS, Inc.

ARCH016-R071911
OLP-2873

Steplites

| Series | Incan. | Fluor. | HID | LED | Exterior | Interior | EM Battery | Other Options |
|--------|--------|--------|-----|-----|----------|----------|------------|--------------------------------------|
| | • | • | | • | • | • | | Satin brass front 277V electrical |

2158 SERIES

Description

The 2158 Series of Steplites offers an ultra low-profile site fixture for low applications. Its width allows relatively wide light distribution to the side in a variety of interior or exterior locations. The rugged construction, engineering excellence, and quality makes this fixture ideal for specification in most public areas.

Features

Louvers in the 2158 Series are more widely spaced than in most fixtures of this type, allowing for significantly greater forward projected illumination. The thick cast aluminum louvered faceplate also provides exceptional durability. Cole Steplites feature an optional cast aluminum junction box which may be easily field mounted to either the back or bottom of the housing to best suit installation conditions.

Applications

The 2158 Series of Steplites are suitable for concrete pour/block wall and stud wall mounting in indoor or outdoor installations. They are ideal in low walls and step risers where wide spacing is desirable.

Custom

If your project demands a special fixture we would be pleased to discuss the production of modified standard fixtures or custom fixtures to suit your specific conditions. For more information on our custom capabilities, please contact your local Cole representative.



C. W. Cole & Company, Inc.
2560 N. Rosemead Boulevard
South El Monte, CA 91733-1593

Fax (626) 443-9253
Tel. (626) 443-2473
info@colelighting.com
www.colelighting.com

Steplites

2158 SERIES

Specifications

Construction

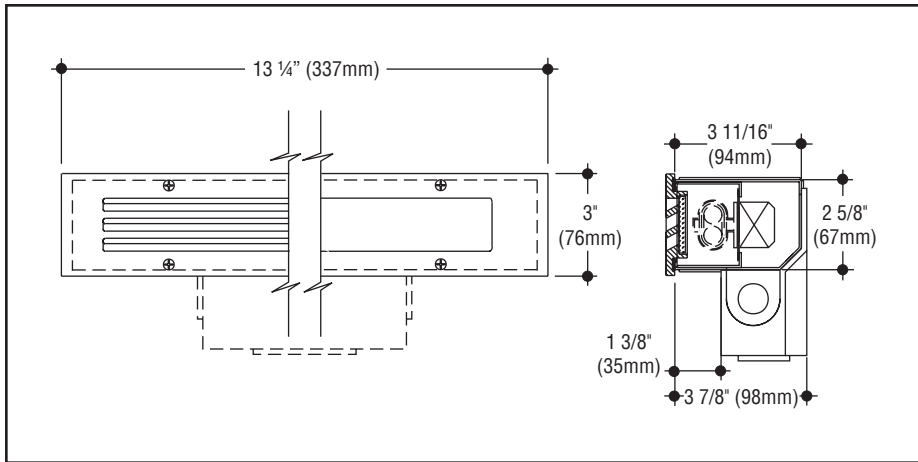
- Fixture housing is constructed from die-formed 16 gauge steel finished with a white polyester coating
- Faceplate is cast aluminum with silver metallic polyester finish or 3/16" stainless steel with brushed finish
- Diffuser on glass front and weatherproof louvered models is frosted tempered glass
- On weatherproof louvered models, diffuser is set in silicone sealant and faceplate is retained by stainless steel screws
- Reflector is constructed of white die-formed aluminum
- Optional junction box is cast aluminum with polyester coating
- cETLus listed, suitable for wet locations when specified weatherproof, in any wall construction

Electrical

- Fixture is wired for compact fluorescent lamp. Ballasts are standard electronic 120V (277V/347V optional)
- Junction box allows 8 wire thru-wiring, four in and four out. Provided with two 1/2" tapped conduit entrances in the bottom and one 1/2" conduit entrance in each side

Mounting

Housing has flange with holes for mounting.



| Catalog Numbers | Faceplate | | |
|---|--------------|------------|-------------|
| | Alum. Louver | Glass | S.S. Louver |
| One 9W (CFT9W/2G7) 4 pin compact fluorescent | F 2158-9 | F 2158G-9 | F 2158-9-N |
| One 13W (CFT13W/2GX7) 4 pin compact fluorescent | F 2158-13 | F 2158G-13 | F 2158-13-N |
| 6W warm white LEDs 3000°K | L 2158 | L 2158G | L 2158N |

Options

Junction Box: Bottom or back mounted junction box as required for feed-thru. Add suffix **-J**.

Weatherproof: For exterior applications.

Add suffix **-W**.

Tamperproof Screws: Tamperproof allen head faceplate screws. Add suffix **-TP**.

Ballasts: 277V or 347V ballast.

Add suffix **-277** or **-347**.

Alternate Faceplate Color: Black or white.

Add suffix **-BLK** or **-WHT**.

Flash Opal Lens: Add suffix **-OPL**.

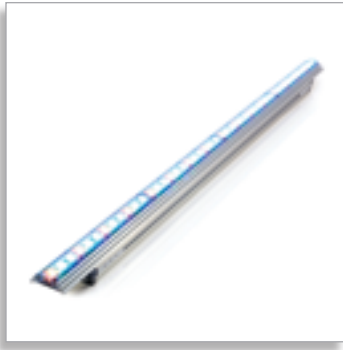
How to Specify

1. Select catalog number with desired features.
2. Add suffixes for options required to meet job conditions.



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South El Monte, CA 91733-1593

Fax (626) 443-9253
Tel. (626) 443-2473
info@colelighting.com
www.colelighting.com



Date: _____ Type: _____

Firm Name: _____

Project: _____

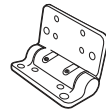
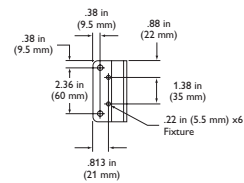
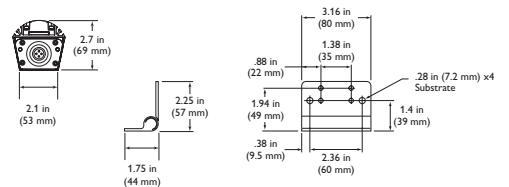
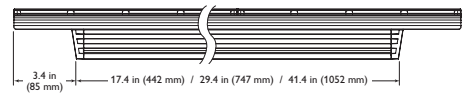
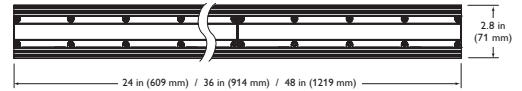
ColorGraze Powercore

30° x 60° beam angle

Linear, color-changing LED surface light for wall washing and grazing

ColorGraze Powercore linear LED lighting fixtures are optimized for surface grazing, wall-wash lighting, and efficient signage illumination. Superior light quality offers uniform beam saturation as close as 6 in (152 mm). A compact, low-profile design combined with flexible mounting options allows for discreet placement within a wide range of architectural features. Intelligent, controllable fixtures are available in standard full-color configurations. Custom configurations with additional beam angles and custom LED channels are also available to support special applications.

- Tailor light output to specific applications — Available in three standard lengths, with standard 10° x 60° and 30° x 60° beam angles. Individually addressable 1 ft (305 mm) segments accommodate fine control of color-changing effects and pre-programmed light shows.
- High-performance illumination and beam quality — ColorGraze Powercore delivers up to 368 lumens of color-changing light per foot. Superior beam quality offers striation-free saturation as close as 6 in (152 mm) from fixture placement with no visible light scalloping between fixtures.
- Integrates Powercore technology — Powercore technology rapidly, efficiently, and accurately controls power output to fixtures directly from line voltage. The Philips Data Enabler Pro merges line voltage with control and delivers them to the fixture over a single standard cable, dramatically simplifying installation and lowering total system cost.
- Versatile installation options — Constant torque locking hinges offer simple and consistent position control from various angles. The low-profile aluminum housing accommodates placement within most architectural niches.
- Superior color consistency — Optibin, a proprietary binning optimization process developed by Philips Color Kinetics, guarantees consistency of hue across LEDs, fixtures, and manufacturing runs.



- Industry-leading controls — ColorGraze Powercore works seamlessly with the complete Philips line of controllers, including Light System Manager, iPlayer 3, and ColorDial Pro, as well as third-party controllers.
- Support for installations requiring conduit to fixtures — ColorGraze Powercore Conduit fixtures have flying leads and threaded openings for 1/2 in NPT conduit to support installations in North America where conduit is required.
- Custom configurations for special applications — You can create custom configurations by exchanging the LED sources in any channel. Options include seven color temperatures ranging from 2700 K to 6500 K, Royal Blue, Blue, Green, Amber, and Red. Additional beam angles (including 9° x 9°, 10° x 30°, and 90° x 60°) are also available. Refer to the ColorGraze Powercore Ordering Information specification sheet for complete details.

For detailed product information, please refer to ColorGraze Powercore Product Guide at www.colorkinetics.com/l/rgb/colorgraze/



Specifications

Due to continuous improvements and innovations, specifications may change without notice.

| Item | Specification | 2 ft (610 mm) | 3 ft (914 mm) | 4 ft (1219 mm) | |
|------------|--|---|---|--|--|
| Output | Beam Angle | 30° x 60° | | | |
| | Lumens* | 736 | 1104 | 1472 | |
| | LED Channels | Red / Green / Blue | | | |
| | Mixing Distance | 6 in (152 mm) to uniform beam saturation | | | |
| | Lumen Maintenance† | 100,000 hours L50 @ 25° C 90,000 hours L50 @ 50° C | | | |
| Electrical | Input Voltage | 100 – 240 VAC, auto-switching, 50 / 60 Hz | | | |
| | Power Consumption at full output, steady state | 35 W maximum | 52.5 W maximum | 70 W maximum | |
| Control | Interface | Data Enabler Pro (DMX or Ethernet) Fixture firmware addressable 8- or 16-bit control | | | |
| | Control System | Philips full range of controllers, including Light System Manager, iPlayer 3, and ColorDial Pro, or third-party controllers | | | |
| Physical | Dimensions (Height x Width x Depth) | 2.7 x 24 x 2.8 in (69 x 610 x 71 mm) | 2.7 x 36 x 2.8 in (69 x 914 x 71 mm) | 2.7 x 48 x 2.8 in (69 x 1219 x 71 mm) | |
| | Weight | 4.9 lb (2.2 kg) | 8.1 lb (3.6 kg) | 10.8 lb (4.9 kg) | |
| | Housing | Extruded anodized aluminum | | | |
| | Lens | Clear polycarbonate | | | |
| | Fixture Connectors | Integral male / female waterproof connectors | | | |
| | Temperature | -40° – 122° F (-40° – 50° C) Operating -4° – 122° F (-20° – 50° C) Startup -40° – 176° F (-40° – 80° C) Storage | | | |
| | Humidity | 0 – 95%, non-condensing | | | |
| | Maximum Fixture Run Length‡ | 37 @ 100 VAC 43 @ 120 VAC 56 @ 220 VAC 56 @ 240 VAC | Configuration: 2 ft (610 mm) fixtures installed end-to-end, 20 A circuit, standard 50 ft (15.2 m) Leader Cable | | |
| | Certification and Safety | Certification | UL / cUL, FCC Class A, CE, PSE, CCC | | |
| | | Environment | Dry / Damp / Wet Location, IP66 | | |

* Measurements comply with IES LM-79-08 testing procedures.

† L50 = 50% maintenance of lumen output (when light output drops below 50% of initial output). Ambient temperatures specified.

‡ These figures, provided as a guideline, are accurate for this configuration only. Changing the configuration can affect the fixture run lengths.



Accessories

| Item | Type | Size | Item Number | Philips 12NC |
|------------------------|-------------|----------------|---------------|--------------|
| Leader Cable | UL / cUL | 50 ft (15.2 m) | 108-000042-00 | 910503700322 |
| | CE / PSE | 50 ft (15.2 m) | 108-000042-01 | 910503700323 |
| Jumper Cable | UL / cUL | End-to-End | 108-000039-00 | 910503700314 |
| | | 1 ft (305 mm) | 108-000039-01 | 910503700315 |
| | | 5 ft (1.5 m) | 108-000039-02 | 910503700316 |
| | CE / PSE | End-to-End | 108-000040-00 | 910503700317 |
| | | 1 ft (305 mm) | 108-000040-01 | 910503700318 |
| | | 5 ft (1.5 m) | 108-000040-02 | 910503700319 |
| Glare Shield | | 1 ft (305 mm) | 120-000081-00 | 910503700745 |
| | | 2 ft (610 mm) | 120-000081-01 | 910503700746 |
| | | 3 ft (914 mm) | 120-000081-02 | 910503700747 |
| | | 4 ft (1.2 m) | 120-000081-03 | 910503700748 |
| Additional Terminators | Quantity 10 | 120-000074-00 | 910503700580 | |
| Additional Hinge | Quantity 1 | 120-000098-00 | 910503700772 | |

Use Item Number when ordering in North America.

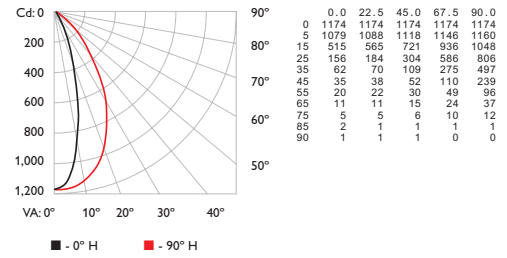


Philips Color Kinetics
3 Burlington Woods Drive
Burlington, Massachusetts 01803 USA
Tel 888.385.5742
Tel 617.423.9999
Fax 617.423.9998
www.philipscolorkinetics.com

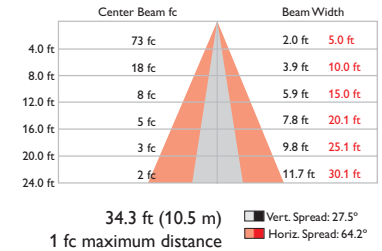
Photometrics

ColorGraze Powercore 2 ft, 30° x 60° beam angle

Polar Candela Distribution



Illuminance at Distance



| LED | Lumens | Efficacy |
|-----|--------|----------|
| RGB | 736 | 16.1 |

For lux multiply fc by 10.7

Fixtures and Data Enabler Pro

| Item | Type | Size | Item Number | Philips 12NC |
|--|---|----------------|---------------|--------------|
| ColorGraze Powercore | 10° x 60° beam angle | 2 ft (610 mm) | 123-000030-00 | 910503700308 |
| | | 3 ft (914 mm) | 123-000030-01 | 910503700309 |
| | | 4 ft (1219 mm) | 123-000030-02 | 910503700310 |
| | 30° x 60° beam angle | 2 ft (610 mm) | 123-000030-03 | 910503700311 |
| | | 3 ft (914 mm) | 123-000030-04 | 910503700312 |
| | | 4 ft (1219 mm) | 123-000030-05 | 910503700313 |
| ColorGraze Powercore Conduit (UL / cUL only) | 10° x 60° beam angle | 2 ft (610 mm) | 123-000020-06 | 910503701833 |
| | | 3 ft (914 mm) | 123-000020-11 | 910503701838 |
| | | 4 ft (1219 mm) | 123-000020-16 | 910503701843 |
| | 30° x 60° beam angle | 2 ft (610 mm) | 123-000020-08 | 910503701835 |
| | | 3 ft (914 mm) | 123-000020-13 | 910503701840 |
| | | 4 ft (1219 mm) | 123-000020-18 | 910503701845 |
| Data Enabler Pro | 3/4 in / 1/2 in NPT (US trade size conduit) | 106-000004-00 | 910503701210 | |
| | PG21 / PG13 (metric size conduit) | 106-000004-01 | 910503701211 | |

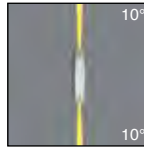
Use Item Number when ordering in North America.

Copyright © 2008 – 2011 Philips Solid-State Lighting Solutions, Inc. All rights reserved. Chromacore, Chromasic, CK, the CK logo, Color Kinetics, the Color Kinetics logo, ColorBlast, ColorBlaze, ColorBurst, eVW Fuse, ColorGraze, ColorPlay, ColorReach, iW Reach, eW Reach, DIMand, EssentialWhite, eVW, iColor, iColor Cove, IntelliWhite, iW, iPlayer, Optibin, and Powercore are either registered trademarks or trademarks of Philips Solid-State Lighting Solutions, Inc. in the United States and / or other countries. All other brand or product names are trademarks or registered trademarks of their respective owners. Due to continuous improvements and innovations, specifications may change without notice. DAS-000010-02 R07 08-11

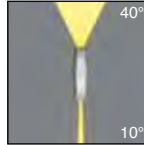
BLADE II LED

A SPECIFY LAMP/LUMINAIRE TYPE

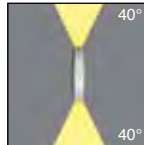
| | | | |
|--------------|---------------------|----------------|-------------------|
| Code: | Narrow beam: | Lumens: | Color CCT: |
| 66 2001 | 2 x 2W LED | 2 x 200lm | 3800K |
| 66 2002 | 2 x 2W LED | 2 x 200lm | 5200K |
| 66 2003 | 2 x 2W LED | 2 x 40lm | blue |



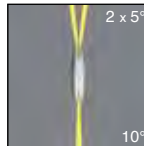
| | | | |
|--------------|--------------------------|----------------|-------------------|
| Code: | Wide/narrow beam: | Lumens: | Color CCT: |
| 66 2011 | 2 x 2W LED | 2 x 200lm | 3800K |
| 66 2012 | 2 x 2W LED | 2 x 200lm | 5200K |
| 66 2013 | 2 x 2W LED | 2 x 40lm | blue |



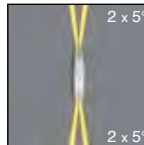
| | | | |
|--------------|-------------------|----------------|-------------------|
| Code: | Wide beam: | Lumens: | Color CCT: |
| 66 2021 | 2 x 2W LED | 2 x 200lm | 3800K |
| 66 2022 | 2 x 2W LED | 2 x 200lm | 5200K |
| 66 2023 | 2 x 2W LED | 2 x 40lm | blue |



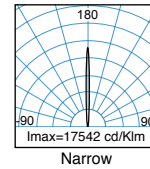
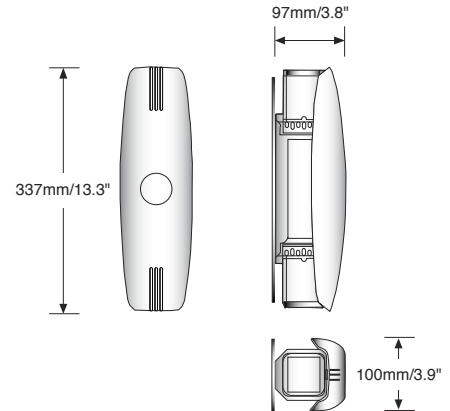
| | | | |
|--------------|--------------------------|----------------|-------------------|
| Code: | Twin narrow beam: | Lumens: | Color CCT: |
| 66 2031 | 2 x 2W LED | 2 x 200lm | 3800K |
| 66 2032 | 2 x 2W LED | 2 x 200lm | 5200K |
| 66 2033 | 2 x 2W LED | 2 x 40lm | blue |



| | | | |
|--------------|--------------------------|----------------|-------------------|
| Code: | Twin narrow beam: | Lumens: | Color CCT: |
| 66 2041 | 2 x 2W LED | 2 x 200lm | 3800K |
| 66 2042 | 2 x 2W LED | 2 x 200lm | 5200K |
| 66 2043 | 2 x 2W LED | 2 x 40lm | blue |

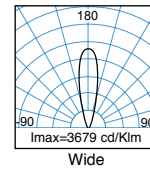


Note: Due to constant changes in LEDs, please check our website for current product specifications.



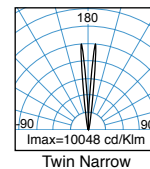
| H (ft) | DIA (ft) | fc |
|--------|----------|-----|
| 15 | 1.0 | 8 |
| 12 | 0.8 | 13 |
| 9 | 0.6 | 24 |
| 6 | 0.4 | 54 |
| 3 | 0.2 | 219 |

Ref: white LEDs



| H (ft) | DIA (ft) | fc |
|--------|----------|----|
| 15 | 5.0 | 2 |
| 12 | 4.0 | 3 |
| 9 | 3.0 | 5 |
| 6 | 2.0 | 11 |
| 3 | 1.0 | 47 |

Ref: white LEDs



| H (ft) | DIA (ft) | fc |
|--------|----------|-----|
| 15 | 6.0 | 5 |
| 12 | 4.8 | 8 |
| 9 | 3.6 | 14 |
| 6 | 2.4 | 32 |
| 3 | 1.2 | 131 |

Ref: white LEDs

EXTERIOR
WALL SURFACE

BLADE II

LED



GENERAL SPECIFICATION

Body and trim: Die-cast aluminum.

Finish: Silver powder coated, RAL9006.

Front fascia: Injection molded plastic, UV stabilized, painted RAL9006. Front fascia can be custom painted to special order.

Gasketing: Heat resistant silicone.

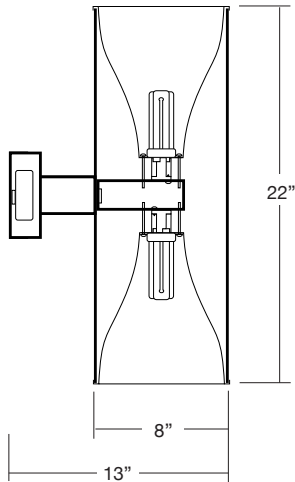
Drivers: HPF, electronic for 120-277V.

Minimum Starting Temperature: -30°C.

Mechanical: Mounts directly over a standard electrical junction box (by others). Blade luminaires can be mounted in any orientation.

Approval: UL, CSA. Wet location, IP67.

8" CYLINDER VERTICAL LAMP UP/DOWNLIGHT



Wall Mount Cylinder



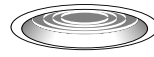
Clear Alzak® Haze



Wheat Alzak® Haze



Black Baffle



Splay with
Fresnel Lens

SPECIFICATION INFORMATION

CYLINDER HOUSING

Constructed of seamless extruded aluminum, with a powder coat finish. 14" standard height; dimming and emergency ballast add 4". Fixture mounts to standard J-box.

REFLECTOR

Reflector is anodized, specular, durable and anti-iridescent; available in 30° cutoff (.30). Finishes are **A**—Clear Alzak® Haze or **G**—Wheat Alzak® Haze

TRIM OPTIONS

B—Black baffle
SP—Splay Fresnel Lens

BALLAST

Electronic enclosed, class P, HPF is supplied standard in 120V or 277V. Ballasts use 4-pin lamps and provide rapid start, .99 power factor with THD<10%.

ELECTRICAL

Ballast mounted in canopy for easy access. U.L. listed for use in damp locations. For wet locations, specify convex lens **WL**.

ACCESSORIES

WL—Wet location convex lens

FINISHES

BM—Brushed Metal, Anodized
BZ—Bronze
K—Black
W—White
S—Silver
CC—Custom Color (Must specify RAL color number.)

ORDERING INFORMATION

LAMP

2-18 18W quad tube
2-26 26W quad tube
2-32 32W triple tube
2-42 42W triple tube

SPECIFY FINISH:

BM—Brushed Metal, anodized
BZ—Bronze
K—Black

120V ELECTRIC

CUV8218.1E 18W quad tube
CUV8226.1E 26W quad tube
CUV8232.1E 32W triple tube
CUV8242.1E 42W triple tube

W—White
S—Silver
CC—Custom Color
Specify RAL color #:

277V ELECTRIC

CUV8218.2E 18W quad tube
CUV8226.2E 26W quad tube
CUV8232.2E 32W triple tube
CUV8242.2E 42W triple tube

SUBMITTAL INFORMATION

TYPE:

PROJECT:

NOTES:

DESCRIPTION:

DELRAY
LIGHTING
INCORPORATED

CUV8200

BURBANK,
CALIFORNIA,

91505

WWW.

DELRAY

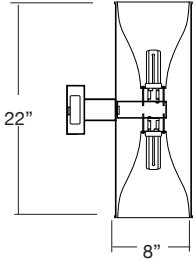
LIGHTING.

COM

NOV 2008

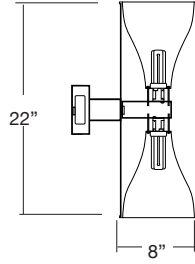
CLEAR ALZAK 30°

CUV8218



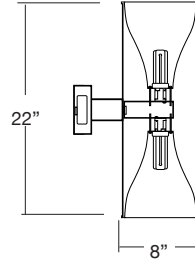
CLEAR ALZAK 30°

CUV8226



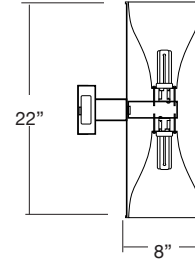
CLEAR ALZAK 30°

CUV8232



CLEAR ALZAK 30°

CUV8242



CONE OF LIGHT

| MTG. HT. | FC/0° | DIA. |
|----------|-------|------|
| 4' | 65 | 3.7 |
| 6' | 29 | 5.5 |
| 8' | 17 | 7.3 |
| 10' | 11 | 9.2 |
| 12' | 8 | 11.0 |

50% FC at edge

| MTG. HT. | FC/0° | DIA. |
|----------|-------|------|
| 4' | 81 | 3.7 |
| 6' | 39 | 5.5 |
| 8' | 19 | 7.3 |
| 10' | 12 | 9.2 |
| 12' | 9 | 11.0 |

50% FC at edge

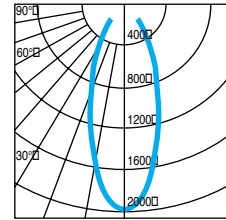
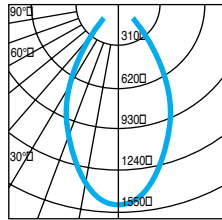
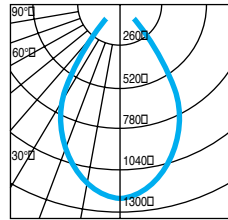
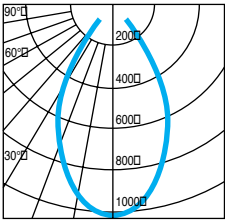
| MTG. HT. | FC/0° | DIA. |
|----------|-------|------|
| 4' | 95 | 4.2 |
| 6' | 42 | 6.4 |
| 8' | 24 | 8.5 |
| 10' | 15 | 10.7 |
| 12' | 11 | 12.8 |

50% FC at edge

| MTG. HT. | FC/0° | DIA. |
|----------|-------|------|
| 4' | 123 | 4.3 |
| 6' | 54 | 6.6 |
| 8' | 31 | 8.8 |
| 10' | 19 | 10.9 |
| 12' | 14 | 12.9 |

50% FC at edge

CP DISTRIBUTION



COEFFICIENTS OF UTILIZATION

| | % CEILING 80 (20% FLOOR) | | |
|----|--------------------------|----|----|
| | % WALL 70 | 50 | 30 |
| 0 | 75 | 75 | 75 |
| 1 | 72 | 71 | 70 |
| 2 | 70 | 67 | 65 |
| 3 | 67 | 64 | 61 |
| 4 | 64 | 60 | 58 |
| 5 | 62 | 57 | 54 |
| 6 | 59 | 55 | 52 |
| 7 | 57 | 52 | 49 |
| 8 | 54 | 49 | 46 |
| 9 | 52 | 47 | 43 |
| 10 | 50 | 44 | 41 |

| | % CEILING 80 (20% FLOOR) | | |
|----|--------------------------|----|----|
| | % WALL 70 | 50 | 30 |
| 0 | 71 | 71 | 71 |
| 1 | 69 | 67 | 66 |
| 2 | 66 | 63 | 61 |
| 3 | 63 | 60 | 57 |
| 4 | 61 | 57 | 54 |
| 5 | 58 | 53 | 50 |
| 6 | 55 | 51 | 48 |
| 7 | 53 | 48 | 45 |
| 8 | 50 | 45 | 42 |
| 9 | 48 | 43 | 39 |
| 10 | 46 | 40 | 37 |

| | % CEILING 80 (20% FLOOR) | | |
|----|--------------------------|----|----|
| | % WALL 70 | 50 | 30 |
| 0 | 84 | 84 | 84 |
| 1 | 80 | 78 | 77 |
| 2 | 77 | 74 | 71 |
| 3 | 73 | 69 | 66 |
| 4 | 70 | 65 | 62 |
| 5 | 67 | 61 | 57 |
| 6 | 63 | 58 | 54 |
| 7 | 60 | 54 | 50 |
| 8 | 57 | 50 | 46 |
| 9 | 54 | 47 | 43 |
| 10 | 51 | 44 | 40 |

| | % CEILING 80 (20% FLOOR) | | |
|----|--------------------------|----|----|
| | % WALL 70 | 50 | 30 |
| 0 | 79 | 79 | 79 |
| 1 | 76 | 74 | 73 |
| 2 | 73 | 70 | 67 |
| 3 | 69 | 66 | 63 |
| 4 | 66 | 62 | 58 |
| 5 | 63 | 58 | 55 |
| 6 | 60 | 55 | 51 |
| 7 | 57 | 51 | 48 |
| 8 | 54 | 48 | 44 |
| 9 | 51 | 45 | 41 |
| 10 | 49 | 42 | 39 |

NOTES

CUV8218

1-18W quad tube
G24q-2 electronic socket
Total lumens: 1250
Spacing criteria: .9
Wheat Alzak x.90

CUV8226

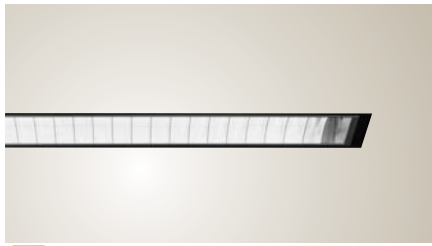
1-26W quad tube
G24q-3 electronic socket
Total lumens: 1800
Spacing criteria: .9
Wheat Alzak x.90

CUV8232

1-32W triple tube
G24q-3 electronic socket
Total lumens: 2400
Spacing criteria: .9
Wheat Alzak x.90

CUV8242

1-42W triple tube
G24q-4 electronic socket
Total lumens: 3200
Spacing criteria: .9
Wheat Alzak x.90



Lightline® Recessed Asymmetric T5 / T5HO

Type:

Project:

SPECIFICATIONS

2 1/2" Aperture

LAR9

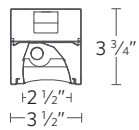
CATALOG NUMBER

FT

Examples: LAR9 G 1 54T5HO LDL U4 120 GEB10 L/LP C201 — LAR9 G 1 14T5 LDL U2 277 GEB10 LP835 C201

AVAILABLE FIXTURES

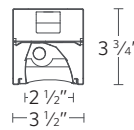
□ LAR9 - 1 2'



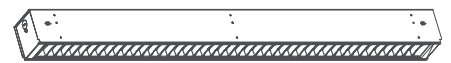
2'



□ LAR9 - 1 4'



4'



SPECIFICATIONS

Construction

Housing is formed from one piece painted cold-rolled steel. Four-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts are finished with low-gloss baked enamel.

Reflectors

White painted reflector system.

Shielding

Arc-shaped, parabolic low iridescent semispecular aluminum louver.

Electrical

Specify 120 volt, 277 volt, or 347 volt. Non EL versions damp location labeled. C-UL listed and labeled. For special circuiting, consult factory.

Fixture Size

Nominal 2 1/2" aperture. 2' and 4' lengths available.

ORDERING LOGIC

| | | | | | | | | FT | | |
|--|--|---|---|----------------------------------|------------------------------|--|--|----|--|--|
| Fixture | Ceiling Type | # of Lamps in Cross Section | Lamp Type | Baffle | Nominal Length | Voltage | Ballast Type | | | |
| LAR9 | G Lay in grid | 1 | 24T5HO 2' 24W T5HO 54T5HO 4' 54W T5HO 14T5 2' 14W T5 28T5 4' 28W T5 | LDL Low Iridescent Louver | U2 2' U4 4' | 120 277 347 | GEB10 <10% ELECTRONIC Dimming Ballasts Available ADEZ ^{1,2} Advance Mark 10 dimming ECO10 ¹ Lutron ECO-10 dimming DMHL ^{1,2} Lutron Hi-Lume (FDB) - Purchased ADZT ^{1,2} Mark 7 (0-10 volt) OSDIM ^{1,2} Osram 0-10v dimming Reference Ballast Chart on website or consult factory for other options. | | | |
| | | | | | | | | | | |
| Emergency Type | Lamp Color | Finish | Options | | | | | | | |
| EL ³ Emergency Battery Pack | L/LP No Lamp LP830 3000k 80+ CRI LP835 3500k 80+ CRI LP841 4100k 80+ CRI Reference Lamp Chart on website or consult factory for other options. | C200 Standard White (low gloss) C201 Black (default) | GLR Fast Blow Fuse GMF Slow Blow Fuse CP Chicago Plenum NYC New York City Calendar FLNG Flange Kit (dry wall only) | | | | | | | |
| Notes: 1 Not available in 347 volt. 2 Only available with 54T5HO. 3 Only available with 28T5 & 54T5HO. | | | | | | | | | | |

Lightline Recessed Asymmetric T5 / T5HO

Type:

Project:

PHOTOMETRICS

2 1/2" Aperture

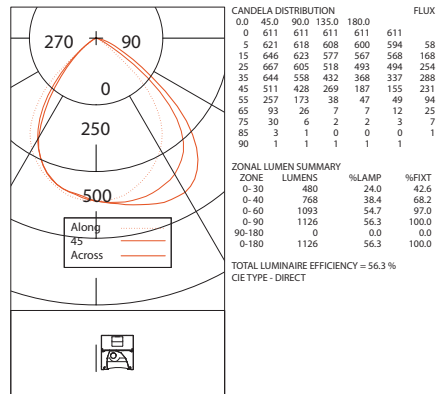
LAR9

1-LAMP 24W T5HO

1-LAMP 54W T5HO

FAR-FIELD PHOTOMETRY
DATE: 12-14-2009
REPORT NUMBER: 8387

CATALOG NUMBER: LAR9-1-24TSHO-WHR-SSB
LUMINAIRE: 3 1/2"W X 3 3/4"H RECESSED ASYMMETRIC DOWNLIGHT WITH
WHITE PAINTED REFLECTOR AND SEMI-SPECULAR BAFFLES
LAMP(S): FP24/835/HO RATED @ 2000 LUMENS
BALLAST: QTP 2X39-24TSHO/UNV PSN
MOUNTING:
LUMEN TO CANDELA RATIO USED = 9.15
TOTAL INPUT WATTS = 26.8 AT 120.0 VOLTS
THE 0 DEGREE PLANE IS PERPENDICULAR TO THE LAMPS.



LUMINANCE DATA IN FOOTLAMBERTS

| ANGLE | AVERAGE | AVERAGE | AVERAGE |
|--------|---------|---------|---------|
| IN DEG | 0-DEG | 45-DEG | 90-DEG |
| 45 | 5444. | 4557. | 2859. |
| 55 | 3390. | 2273. | 495. |
| 65 | 1658. | 458. | 126. |
| 75 | 874. | 180. | 51. |
| 85 | 227. | 76. | 0. |

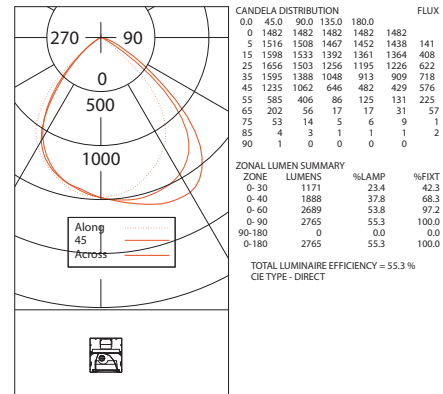
APPROVED BY:



BARE LAMP LUMEN VALUE IS RATED AT LAMP OPERATING TEMPERATURE INSIDE THE LUMINAIRE.
FOR DETAIL EXPLANATIONS, PLEASE SEE PEERLESS PUBLICATION # A62

FAR-FIELD PHOTOMETRY
DATE: 12-3-2009
REPORT NUMBER: 8363

CATALOG NUMBER: LAR9-1-54TSHO-WHR-SSB
LUMINAIRE: 3 1/2"W X 3 3/4"H RECESSED ASYMMETRIC DOWNLIGHT WITH
WHITE PAINTED REFLECTOR AND SEMI-SPECULAR BAFFLES
LAMP(S): FS4/835/HO/EA 49W RATED @ 5000 LUMENS
BALLAST: QTP 2X54TSHO/UNV PSN
MOUNTING:
LUMEN TO CANDELA RATIO USED = 9.15
TOTAL INPUT WATTS = 51.8 AT 120.0 VOLTS
THE 0 DEGREE PLANE IS PERPENDICULAR TO THE LAMPS.



LUMINANCE DATA IN FOOTLAMBERTS

| ANGLE | AVERAGE | AVERAGE | AVERAGE |
|--------|---------|---------|---------|
| IN DEG | 0-DEG | 45-DEG | 90-DEG |
| 45 | 6883. | 5659. | 3440. |
| 55 | 3848. | 2667. | 563. |
| 65 | 1801. | 498. | 149. |
| 75 | 771. | 210. | 68. |
| 85 | 160. | 140. | 40. |

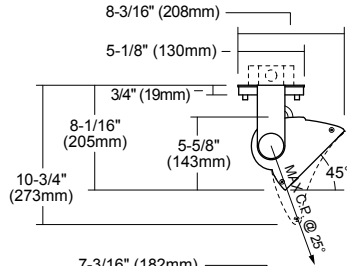
APPROVED BY:



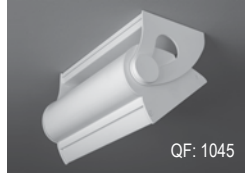
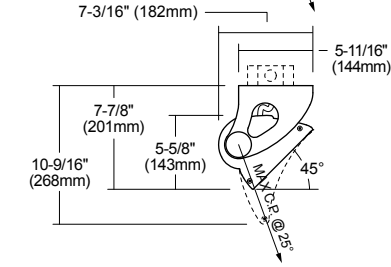
BARE LAMP LUMEN VALUE IS RATED AT LAMP OPERATING TEMPERATURE INSIDE THE LUMINAIRE.
FOR DETAIL EXPLANATIONS, PLEASE SEE PEERLESS PUBLICATION # A62

MOUNTING DETAILS

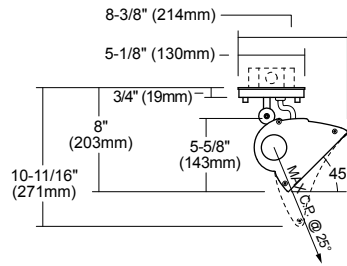
REMOTE BALLAST



LS8 Large Simple Mount

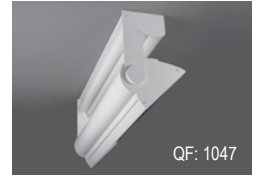
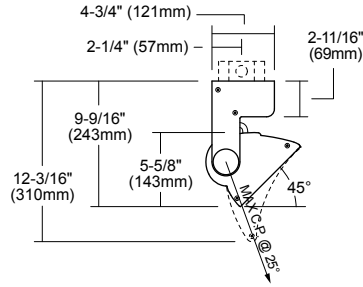


LD8 Large Deco Mount

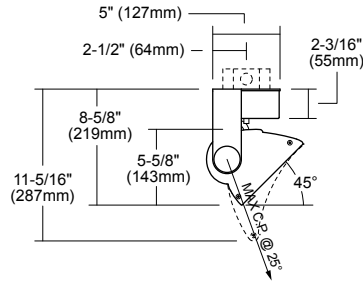


LK8 Large Knuckle Mount

INTEGRAL BALLAST



LS9 Large Simple Mount



LS13 Large Simple Mount

MOUNTING- All standard mounts are fully adjustable and lockable. Designed for remote or integral ballast. See Mounting Details above.

TYPE- Large profile with smooth or ribbed detail.
Indoor; Non-gasketed, captive extruded aluminum hinge for lens and baffle options.
Outdoor; Silicone gasketed lens, captive extruded aluminum door with window cut-out for regressed lens.
Lens; Open aperture is standard for indoor fixtures. Outdoor fixtures are equipped with clear acrylic lens.

PERFORMANCE- Asymmetric distribution provides a concentration of light on target surface for smooth illumination. Maximum candlepower aimed 25° above nadir has less than 10% spill light within the 0-25° zone and less than 2% spill light within the 90-180° zone.

ELECTRICAL- Electronic, HPF ballast, lamp protection circuit, and thermally protected. Provide 90°C supply wire. See Technical section for specific ballast data.

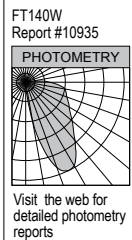
PROFILE- P1 (basic): Anodized, extruded aluminum specular reflector with solid aluminum endcaps and stainless steel hardware. Extruded aluminum glare control visor can be combined with P1 basic profile to create P5 profile.

FINISHES- An electrostatically applied wet paint system utilizes a multi-stage process to provide a durable acrylic enamel finish. Suitable for indoor and outdoor applications.

• Winona Lighting reserves the right to make design revisions without prior notice.

PRODUCT SPECIFICATION

| MOUNTING | TYPE | LAMP CODE | | | | VOLTAGE | PROFILE | FINISH | OPTIONS | CLASS | |
|--------------------|--------|---|-------------------|------------------------|------------------------|------------------------------------|------------------------------|---|---|----------------------------------|------------------------|
| | | LAMP CODE | DESCRIPTION | LENGTH | WEIGHT | | | | | | |
| Remote Ballast | Indoor | Compact Fluorescent | | | | 120V - 120 volt 277V - 277 volt | P1 (basic) P5 (short) | SGW - semi gloss white ALP - aluminum paint (matte) SGB - semi gloss black ABP - antique brass paint LGP - light gold iridescent paint LSP - light silver paint MBP - medium bronze paint PBP - pale bronze paint PEW - pewter paint PGP - pale gold paint SPF - standard paint finish CPF - custom paint finish (consult factory) | X - no options CA - clear acrylic lens (CFM lamps only) EM - emergency battery (remote mounted) MP - micro-prismatic glass (CFM lamps only) PB - parabolic blade baffle (internal mount-N/A for wet) SB - straight blade baffle (external mount) SO - special options | STD - standard MOD - modified | |
| | | LS8 - simple yoke | LS - large smooth | CFM132 (1) CFM32W/GX24 | 12" | | | | | | 8 lbs. |
| | | LD8 - deco yoke | LR - large ribbed | CFM142 (1) CFM42W/GX24 | 12" | | | | | | 8 lbs. |
| | | LK8 - knuckle | Outdoor | CFM157 (1) CFM57W/GX24 | 12" | | | | | | 8 lbs. |
| | | | | CFM170 (1) CFM70W/GX24 | 16" | | | | | | 10 lbs. |
| | | Integral Ballast | Outdoor | CFM232 (2) CFM32W/GX24 | 20" | | | | | | 13 lbs. |
| | | | | CFM242 (2) CFM42W/GX24 | 20" | | | | | | 13 lbs. |
| | | | | CFM257 (2) CFM57W/GX24 | 20" | | | | | | 13 lbs. |
| | | | | CFM270 (2) CFM70W/GX24 | 25" | | | | | | 19 lbs. |
| | | | | LS9 - simple yoke | LSW - large smooth wet | | | | | | † FT139 (1) FT39W/2G11 |
| LS13 - simple yoke | | | | † FT239 (2) FT39W/2G11 | 20" | 13 lbs. | | | | | |
| | | | | † FT140 (1) FT40W/2G11 | 25" | 19 lbs. | | | | | |
| | | | | † FT240 (2) FT40W/2G11 | 25" | 19 lbs. | | | | | |
| | | | | † FT150 (1) FT50W/2G11 | 25" | 19 lbs. | | | | | |
| | | | | † FT250 (2) FT50W/2G11 | 25" | 19 lbs. | | | | | |
| | | † FT155 (1) FT55W/2G11 | 25" | 19 lbs. | | | | | | | |
| | | † FT255 (2) FT55W/2G11 | 25" | 19 lbs. | | | | | | | |
| | | † Not available for wet label | | | | | | | | | |
| | | Linear Fluorescent | | | | | | | | | |
| | | For single linear or continuous row applications see Surface Linear Tab. | | | | | | | | | |
| | | Note: Lamps not included | | | | | | | | | |



Visit www.winonalighting.com for the most complete and current information.

UL All fixtures UL listed, USA and Canada

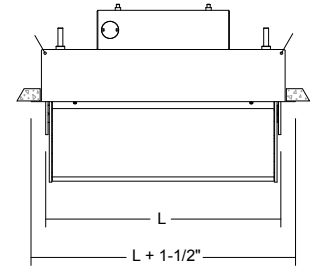
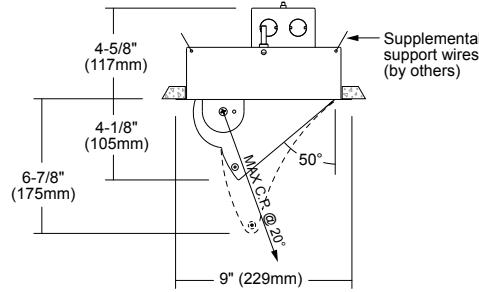
Fluorescent • Large Ceiling Semi-Recessed

MOUNTING DETAILS

LSRU - Universal Mount



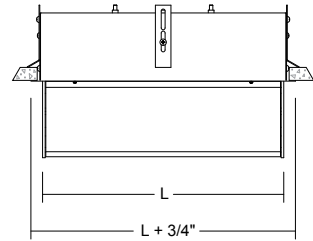
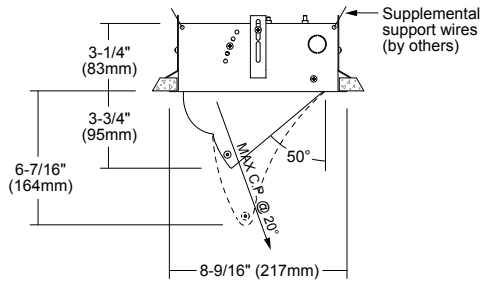
LSRU Large Universal Mount Semi-Recessed



LSRS - Simple Mount (For use in accessible ceilings only)



LSRS Large Simple Mount Semi-Recessed



MOUNTING- 20 ga. CRS painted housing, welded construction, integral ballast, and painted finish. See Mounting Details above.

Universal; Adjustable and lockable yoke design with aiming adjustment below ceiling. Installation from above or below ceiling (accessible or inaccessible ceiling types). Additional support may be required by local codes. Auxiliary mounting holes are provided with hanger wire or threaded rods (by others).

Simple; Adjustable and lockable features concealed above ceiling with painted steel trim. Installation from above ceiling only (accessible ceiling types only). Ballast compartment provided with conduit knock-outs. Supplemental supports are required for accessible ceilings (either hanger wires or C-channels, not included). If hanger wire suspension is not possible, specify Hanger bracket (HB) option to accept suspension bars (not provided).

TYPE- Large profile with smooth or ribbed detail.

Indoor; Non-gasketed, captive extruded aluminum hinge for lens and baffle options.

Lens; Open aperture is standard for indoor fixtures. Outdoor fixtures shall be specified with clear acrylic lens option.

PERFORMANCE- Asymmetric distribution provides a concentration of light on target surface for smooth illumination. Maximum candlepower aimed 20° above nadir has less than 10% spill light within the 0-20° zone and less than 2% spill light within the 90-180° zone.

ELECTRICAL- Integral electronic HPF ballast, lamp protection circuit, and thermally protected. Provide 90°C supply wire.

PROFILE-P1 (basic): Anodized, extruded aluminum specular reflector with solid aluminum endcaps and stainless steel hardware. Extruded aluminum glare control visor can be combined with P1 basic profile to create P5 profile.

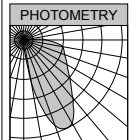
FINISHES- An electrostatically applied wet paint system utilizes a multi-stage process to provide a durable acrylic enamel finish.

• Winona Lighting reserves the right to make design revisions without prior notice.

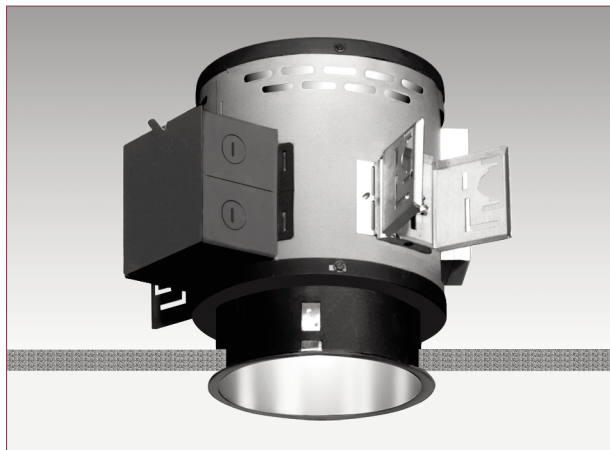
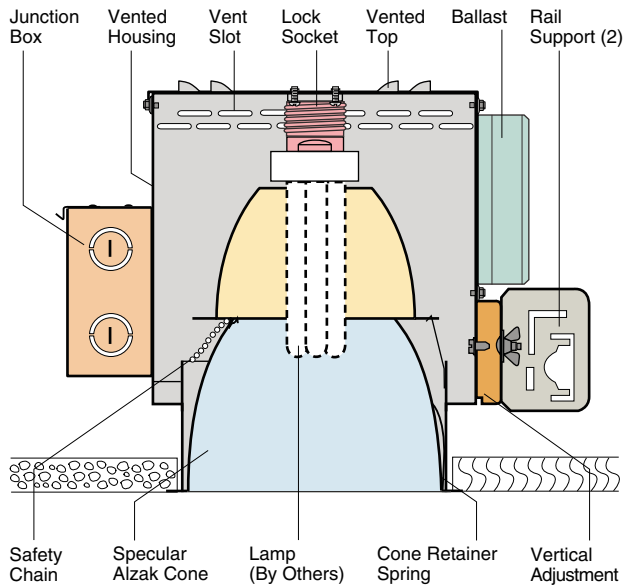
PRODUCT SPECIFICATION

| MOUNTING | TYPE | LAMP CODE | | | | VOLTAGE | PROFILE | FINISH | OPTIONS | CLASS |
|--|--|--|-----------------|---------|---------|-----------------|------------|---|---|----------------|
| Integral Ballast | Indoor | LAMP CODE | DESCRIPTION | LENGTH | WEIGHT | 120V - 120 volt | | | | STD - standard |
| LSRU - universal | damp label LS - large smooth LR - large ribbed | Universal Mount (Compact Fluorescent) | | | | 277V - 277 volt | P1 (basic) | SGW - semi gloss white ALP - aluminum paint (matte) SGB - semi gloss black ABP - antique brass paint LGP - light gold iridescent paint LSP - light silver paint MBP - medium bronze paint PBP - pale bronze paint PEW - pewter paint PGP - pale gold paint SPF - standard paint finish CPF - custom paint finish (consult factory) | X - no options CA - clear acrylic lens (CFM lamps only) EM - emergency battery (remote mounted) HB - hanger bracket (see product text) MP - micro-prismatic glass (CFM lamps only) PB - parabolic blade baffle (internal mount) PL - plenum rated (consult factory) SB - straight blade baffle (CFM lamps only) (external mount) SO - special options | MOD - modified |
| | | CFM132 | (1) CFM32W/GX24 | 13-1/2" | 8 lbs. | | | | | |
| | | CFM142 | (1) CFM42W/GX24 | 13-1/2" | 8 lbs. | | | | | |
| | | CFM157 | (1) CFM57W/GX24 | 13-1/2" | 8 lbs. | | | | | |
| | | CFM170 | (1) CFM70W/GX24 | 17-1/2" | 10 lbs. | | | | | |
| | | CFM232 | (2) CFM32W/GX24 | 21-1/2" | 16 lbs. | | | | | |
| | | CFM242 | (2) CFM42W/GX24 | 21-1/2" | 16 lbs. | | | | | |
| | | CFM257 | (2) CFM57W/GX24 | 21-1/2" | 16 lbs. | | | | | |
| | | † CFM270 | (2) CFM70W/GX24 | 26-1/2" | 21 lbs. | | | | | |
| | | FT139 | (1) FT39W/2G11 | 21-1/2" | 16 lbs. | | | | | |
| | | FT239 | (2) FT39W/2G11 | 21-1/2" | 16 lbs. | | | | | |
| | | † FT140 | (1) FT40W/2G11 | 26-1/2" | 21 lbs. | | | | | |
| | | † FT240 | (2) FT40W/2G11 | 26-1/2" | 21 lbs. | | | | | |
| | | † FT150 | (1) FT50W/2G11 | 26-1/2" | 21 lbs. | | | | | |
| | | † FT250 | (2) FT50W/2G11 | 26-1/2" | 21 lbs. | | | | | |
| † FT155 | (1) FT55W/2G11 | 26-1/2" | 21 lbs. | | | | | | | |
| † FT255 | (2) FT55W/2G11 | 26-1/2" | 21 lbs. | | | | | | | |
| | | Simple Mount (Accessible Ceiling Only) | | | | | | | | |
| | | CFM132 | (1) CFM32W/GX24 | 12-3/4" | 8 lbs. | | | | | |
| | | CFM142 | (1) CFM42W/GX24 | 12-3/4" | 8 lbs. | | | | | |
| | | CFM157 | (1) CFM57W/GX24 | 12-3/4" | 8 lbs. | | | | | |
| | | CFM170 | (1) CFM70W/GX24 | 20-3/4" | 16 lbs. | | | | | |
| | | CFM232 | (2) CFM32W/GX24 | 20-3/4" | 16 lbs. | | | | | |
| | | CFM242 | (2) CFM42W/GX24 | 20-3/4" | 16 lbs. | | | | | |
| | | CFM257 | (2) CFM57W/GX24 | 20-3/4" | 16 lbs. | | | | | |
| | | CFM270 | (2) CFM70W/GX24 | 23-3/4" | 21 lbs. | | | | | |
| | | FT139 | (1) FT39W/2G11 | 20-3/4" | 16 lbs. | | | | | |
| | | FT239 | (2) FT39W/2G11 | 20-3/4" | 16 lbs. | | | | | |
| | | FT140 | (1) FT40W/2G11 | 23-3/4" | 21 lbs. | | | | | |
| | | FT240 | (2) FT40W/2G11 | 23-3/4" | 21 lbs. | | | | | |
| | | FT150 | (1) FT50W/2G11 | 23-3/4" | 21 lbs. | | | | | |
| | | FT250 | (2) FT50W/2G11 | 23-3/4" | 21 lbs. | | | | | |
| | | FT155 | (1) FT55W/2G11 | 23-3/4" | 21 lbs. | | | | | |
| | | FT255 | (2) FT55W/2G11 | 23-3/4" | 21 lbs. | | | | | |
| † Will not fit in standard 2' x 2' t-bar ceiling. Note: Lamps not included | | | | | | | | | | |

FT140W
Report #10935



Visit the web for detailed photometry reports



P926 One 26W or 32W Triple Tube Lamp
P927 One 42W Triple Tube Lamp

Medium Beam
5 7/8" Conoid Apertures

Optics and Applications

Distribution from a single vertically mounted triple tube lamp is for general lighting. Spacing to mounting height ratios range from .93 to 1.11 depending upon which lamp is mounted. Use in corridors, entries, work stations or open area lighting in low to medium height ceilings.

Design Features

The two reflector optical system is protected by a rigid steel housing which keeps the reflectors in proper relationship to each other. The twist and lock socket prevents the lamp from falling if it is not properly engaged. It is a dependable fail-safe mechanism to prevent injury and litigation. Maximum ceiling thickness is 2". Ballast and lamp service from below.

Finish

Specular clear Alzak cones are standard. Optional colors and Softglow® finishes are available. Housings and structural parts are painted optical matte black to suppress stray light leaks. Steel parts are phosphate conditioned for corrosion resistance before painting.

Ballasts

Fully electronic, microprocessor controlled with variable starting current for inrush protection to assure rated lamp life. Input voltage ranges from 120V through 277V. Power factor .98, starting temperature 0° F (-18° C), THD < 10%. Pre-heat start < 1.0 second. End of lamp life protection. Rated for > 50,000 starts.

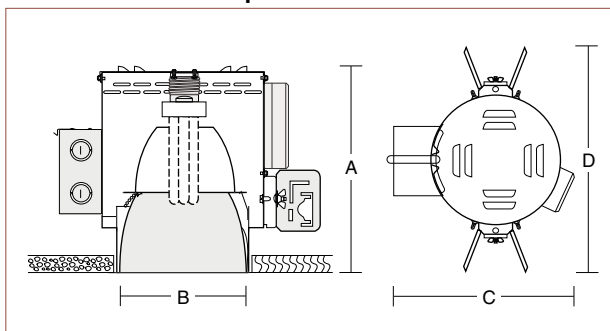
General

Fixtures are pre-wired, UL and C-UL listed for eight wire 75°C branch circuit wiring. Union made IBEW. Luminaire Efficiency Rating (LER) data is in the photometric directory located in Section Z.

Accessories

- G Gold cone.
- H Mocha cone.
- P Graphite cone.
- T Titanium cone.
- W Wheat cone.
- Y Pewter cone.
- Z Bronze cone.
- S Softglow® finishes: add S before color letters. e.g. SW for Softglow® wheat cone, SC for Softglow® clear cone.
- DM Dimming ballast. Specify watts and volts.
- EM Emergency power includes integral charger light and test switch visible through aperture. Single lamp operation for 90 minutes. Specify volts.
- WRL Wattage restriction label, specify wattage.
- R2 26" support rails.
- R5 52" support rails.
- WT White trim flange.
- WHT White complete trim.
- V347 347 volt ballast.
- F Fuse.

Dimensions and Lamps



| Number | A Depth* | B Aperture | C Width | D Length | Lamps |
|--------|------------------|-----------------|------------------|------------------|---------------------------|
| P926 | 9 3/4" 248mm | 5 7/8" 149mm | 10 1/2" 267mm | 13 1/4" 337mm | 26W or 32W Triple Tube |
| P927 | 10 1/4" 260mm | 5 7/8" 149mm | 10 1/2" 267mm | 13 1/4" 337mm | 42W Triple Tube |

*Recess depth increases to 12 1/2" with EM and DM accessories.

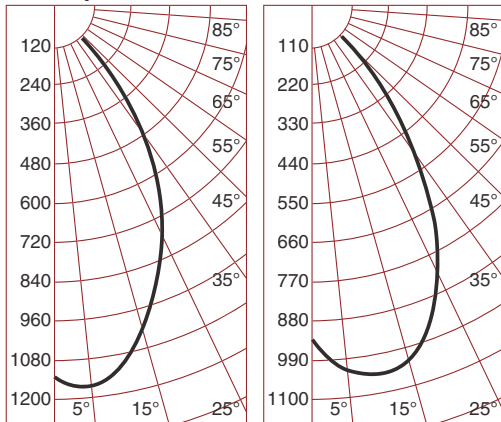
P51 P926 P927

Performance Datachart

| Single Unit Initial Footcandles, 30" Work Plane | | | | | | Ceiling to Floor | Multiple Units Initial Footcandles, 30" Work Plane | | | |
|---|----------|----------|----------|----------|----------|------------------|--|----------|----------|------|
| P926 One 32W Osram Triple Tube Read Top Data | | | | | | 8' | Ceiling 80% Walls 50% Floor 20% | | | |
| P927 One 42W Osram Triple Tube Read Bottom Data | | | | | | | Spacing is Maximum Over Work Plane | | | |
| Nadir | 10° | | 20° | | 30° | Spacing | RCR 1 | RCR 3 | RCR 8 | |
| FC | FC | Diam | FC | Diam | FC | | | | | Diam |
| 37 47 | 35 42 | 2' 2' | 25 30 | 4' 4' | 13 17 | 6' | 49 66 | 42 56 | 30 39 | |
| 27 33 | 25 30 | 2' 2' | 18 21 | 5' 5' | 10 12 | 8' | 35 47 | 30 40 | 21 28 | |
| 20 25 | 19 23 | 3' 3' | 14 16 | 5' 5' | 7 9 | 9' | 26 36 | 23 30 | 16 21 | |
| 13 16 | 12 14 | 3' 3' | 8 10 | 7' 7' | 4 6 | 11' | 17 22 | 14 19 | 10 13 | |
| 9 11 | 8 10 | 4' 4' | 6 7 | 8' 8' | 3 4 | 13' | 11 11 | 10 15 | 7 9 | |

See notes 4, 5 and 6.

Candlepower Distribution



P926 32W Triple Tube Osram
Eff. 50% S/M .95

P926 32W Triple Tube Philips
Eff. 50% S/M 1.11

Candelas

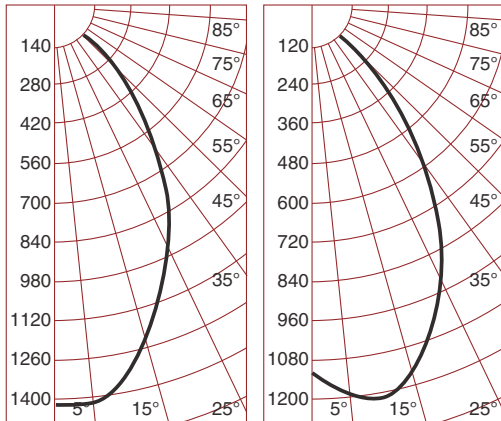
| o | O 32W | P 32W |
|----|-------|-------|
| | 2400* | 2400* |
| 0 | 1134 | 938 |
| 5 | 1152 | 1021 |
| 10 | 1109 | 1055 |
| 15 | 1023 | 1020 |
| 20 | 916 | 956 |
| 25 | 789 | 837 |
| 30 | 625 | 667 |
| 35 | 460 | 467 |
| 40 | 353 | 321 |
| 45 | 212 | 173 |
| 50 | 19 | 16 |
| 55 | 7 | 6 |
| 60 | 0 | 0 |
| 65 | 0 | 0 |
| 70 | 0 | 0 |
| 75 | 0 | 0 |
| 80 | 0 | 0 |
| 85 | 0 | 0 |
| 90 | 0 | 0 |

o Vertical Angles
* Initial Lamp Lumens

Coefficients of Utilization

| Ceiling | 80% | | | | 70% | | | | 50% | | | | 30% | | | | 0 | | | | | |
|---------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 70 | 50 | 30 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | | |
| RCR | Zonal Cavity Method - Floor Reflectance 20% | | | | | | | | | | | | | | | | | | | | | |
| 1 | .57 | .56 | .55 | .53 | .55 | .52 | .53 | .51 | .51 | .49 | .47 | .57 | .56 | .55 | .53 | .55 | .52 | .53 | .51 | .51 | .49 | .47 |
| 2 | .54 | .52 | .50 | .48 | .51 | .47 | .49 | .46 | .48 | .45 | .43 | .54 | .52 | .50 | .48 | .51 | .47 | .49 | .46 | .48 | .45 | .43 |
| 3 | .51 | .48 | .45 | .43 | .47 | .43 | .46 | .42 | .45 | .41 | .40 | .51 | .48 | .45 | .43 | .47 | .43 | .46 | .42 | .45 | .41 | .40 |
| 4 | .48 | .44 | .41 | .39 | .44 | .39 | .43 | .38 | .42 | .38 | .37 | .48 | .44 | .41 | .39 | .44 | .39 | .43 | .38 | .42 | .38 | .37 |
| 5 | .46 | .41 | .38 | .36 | .41 | .36 | .40 | .35 | .39 | .35 | .34 | .46 | .41 | .38 | .36 | .41 | .36 | .40 | .35 | .39 | .35 | .34 |
| 6 | .43 | .38 | .35 | .33 | .38 | .33 | .37 | .33 | .36 | .32 | .31 | .43 | .38 | .35 | .33 | .38 | .33 | .37 | .33 | .36 | .32 | .31 |
| 7 | .41 | .36 | .33 | .30 | .35 | .30 | .35 | .30 | .34 | .30 | .29 | .41 | .36 | .33 | .30 | .35 | .30 | .35 | .30 | .34 | .30 | .29 |
| 8 | .39 | .34 | .30 | .28 | .33 | .28 | .33 | .28 | .32 | .28 | .27 | .39 | .34 | .30 | .28 | .33 | .28 | .33 | .28 | .32 | .28 | .27 |
| 9 | .37 | .31 | .28 | .26 | .31 | .26 | .31 | .26 | .30 | .26 | .25 | .37 | .31 | .28 | .26 | .31 | .26 | .31 | .26 | .30 | .26 | .25 |
| 10 | .35 | .30 | .26 | .24 | .29 | .24 | .29 | .24 | .28 | .24 | .23 | .35 | .30 | .26 | .24 | .29 | .24 | .29 | .24 | .28 | .24 | .23 |

P926 One 32W Triple Tube Osram Sylvania
P926 One 32W Triple Tube Philips x .98



P927 42W Triple Tube Osram
Eff. 48% S/M .93

P927 42W Triple Tube Philips
Eff. 44% S/M 1.07

| o | O 42W | P 42W |
|----|-------|-------|
| | 3200* | 3200* |
| 0 | 1412 | 1104 |
| 5 | 1403 | 1188 |
| 10 | 1328 | 1211 |
| 15 | 1176 | 1154 |
| 20 | 1092 | 1063 |
| 25 | 958 | 919 |
| 30 | 789 | 747 |
| 35 | 611 | 583 |
| 40 | 487 | 441 |
| 45 | 355 | 253 |
| 50 | 75 | 23 |
| 55 | 10 | 8 |
| 60 | 0 | 0 |
| 65 | 0 | 0 |
| 70 | 0 | 0 |
| 75 | 0 | 0 |
| 80 | 0 | 0 |
| 85 | 0 | 0 |
| 90 | 0 | 0 |

o Vertical Angles
* Initial Lamp Lumens

| Ceiling | 80% | | | | 70% | | | | 50% | | | | 30% | | | | 0 | | | | | |
|---------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 70 | 50 | 30 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | 50 | 10 | | |
| RCR | Zonal Cavity Method - Floor Reflectance 20% | | | | | | | | | | | | | | | | | | | | | |
| 1 | .56 | .55 | .54 | .53 | .54 | .52 | .52 | .50 | .50 | .49 | .46 | .56 | .55 | .54 | .53 | .54 | .52 | .52 | .50 | .50 | .49 | .46 |
| 2 | .53 | .51 | .49 | .47 | .50 | .47 | .48 | .46 | .47 | .45 | .43 | .53 | .51 | .49 | .47 | .50 | .47 | .48 | .46 | .47 | .45 | .43 |
| 3 | .51 | .47 | .45 | .43 | .47 | .42 | .45 | .42 | .44 | .41 | .39 | .51 | .47 | .45 | .43 | .47 | .42 | .45 | .42 | .44 | .41 | .39 |
| 4 | .48 | .44 | .41 | .39 | .43 | .38 | .42 | .38 | .41 | .38 | .36 | .48 | .44 | .41 | .39 | .43 | .38 | .42 | .38 | .41 | .38 | .36 |
| 5 | .45 | .41 | .38 | .35 | .40 | .35 | .39 | .35 | .39 | .35 | .34 | .45 | .41 | .38 | .35 | .40 | .35 | .39 | .35 | .39 | .35 | .34 |
| 6 | .43 | .38 | .35 | .33 | .38 | .32 | .37 | .32 | .36 | .32 | .31 | .43 | .38 | .35 | .33 | .38 | .32 | .37 | .32 | .36 | .32 | .31 |
| 7 | .40 | .35 | .32 | .30 | .35 | .30 | .34 | .30 | .34 | .30 | .29 | .40 | .35 | .32 | .30 | .35 | .30 | .34 | .30 | .34 | .30 | .29 |
| 8 | .38 | .33 | .30 | .28 | .33 | .28 | .32 | .28 | .32 | .27 | .27 | .38 | .33 | .30 | .28 | .33 | .28 | .32 | .28 | .32 | .27 | .27 |
| 9 | .36 | .31 | .28 | .26 | .31 | .26 | .30 | .26 | .30 | .26 | .25 | .36 | .31 | .28 | .26 | .31 | .26 | .30 | .26 | .30 | .26 | .25 |
| 10 | .34 | .29 | .26 | .24 | .29 | .24 | .29 | .24 | .28 | .24 | .23 | .34 | .29 | .26 | .24 | .29 | .24 | .29 | .24 | .28 | .24 | .23 |

P927 One 42W Triple Tube Osram Sylvania
P927 One 42W Triple Tube Philips x .89

Brightness

| Number | Lamps | 85° | 75° | 65° | 55° | 45° |
|--------|--------------------------------|-----|-----|-----|-----|-------|
| P926 | 32W Osram Sylvania Triple Tube | 10 | 33 | 66 | 150 | 12837 |
| | 32W Philips Triple Tube | 12 | 34 | 62 | 151 | 10756 |
| P927 | 42W Osram Sylvania Triple Tube | 14 | 45 | 91 | 208 | 17796 |
| | 42W Philips Triple Tube | 15 | 45 | 82 | 203 | 14468 |

Data in footlamberts. Photometer readings, Maximum Brightness Method. See note 7.

Notes

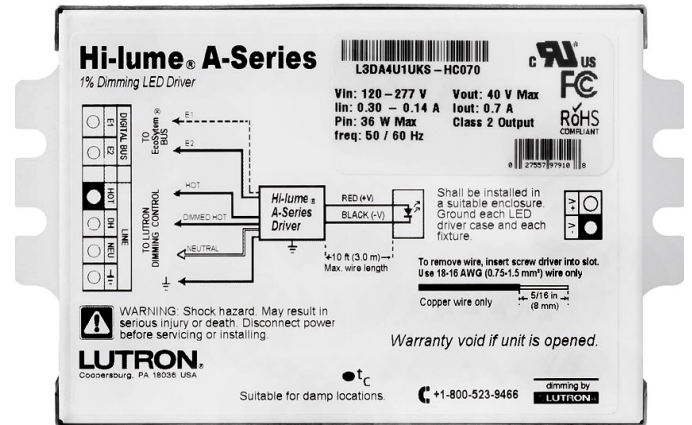
- Data on all charts calculated with a clear specular cone finish.
- Specular cone multipliers: Wheat x .84, Pewter x .79, Mocha x .78, Graphite x .75, Titanium x .75, Bronze x .72.
- Softglow® cone multipliers: Wheat x .71, Mocha x .68, Pewter x .65, Graphite x .64, Titanium x .64, Bronze x .61.
- Single unit Datachart pattern diameters are determined by the number of degrees from each side of nadir. Therefore a 20° diameter represents a total 40° pattern width at the work plane 30" above the floor. Footcandle values are at the edge of that diameter.
- Datachart spacing is rounded off to the nearest foot.
- Data by IES methods. Compact fluorescent data vary due to lamp differences, power input, burning position, ambient temperature and ballast characteristics. Apply a modification factor.
- Brightness data from the Average Luminance Method are inaccurate for small aperture downlights. They are theoretical calculations derived for large surfaces such as troffers. For a complete discussion refer to section Z brochure Z1.

Hi-lume® A-Series Driver Overview EcoSystem® or 3-wire control

Hi-lume® A-Series Driver is a high-performance LED driver that provides smooth, continuous 1% dimming for virtually any LED fixture, whether it requires constant current or constant voltage. It is the most versatile LED driver offered today due to its compatibility with a wide variety of LED arrays, multiple form factors, and numerous control options.

Features

- Continuous, flicker-free dimming from 100% to 1%.
- Compatible with Energi Savr Node™ with EcoSystem® unit, GRAFIK Eye® QS control unit, PowPak™ dimming module with EcoSystem®, and Quantum® systems, allowing for integration into a planned or existing EcoSystem® lighting control solution. Please see chart at the end of this document or contact Lutron for details regarding compatible controls.
- Standard 3-wire line-voltage phase-control technology for consistent dimming performance and compatibility with all Lutron® 3-wire fluorescent controls.
- Protected from miswires of input power to EcoSystem® control inputs.
- 100% performance tested at factory.
- 100% burned in at factory.
- A rated lifetime of 50,000 hours @ $t_c = 149^\circ\text{F}$ (65°C).
- UL recognized for United States and Canada.
- FCC Part 15 compliant for commercial applications at 120 V~ or 277 V~.
- Pulse Width Modulation (PWM) or Constant Current Reduction (CCR) dimming methods available. See Application Note #360 for details.
- For more information please go to: www.lutron.com/HilumeLED



Hi-lume® A-Series, case type K

3.00 in (76 mm) W x 1.00 in (25 mm) H x
4.90 in (124 mm) L



Hi-lume® A-Series, case type M

1.18 in (30 mm) W x 1.00 in (25 mm) H x 14.25 in
(362 mm) L

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Specifications

Performance

- Dimming Range: 100% to 1%
- Operating Voltage: 120-277 V \sim at 50/60 Hz
- A rated lifetime of 50,000 hours @ $t_c = 149$ °F (65 °C). Contact Lutron for derating information.
- Patented thermal foldback protection
- LEDs turn on to any dimmed level without going to full brightness.
- Nonvolatile memory restores all driver settings after power failure.
- Power Factor: > 0.90 at 40 W
- Standby Power Consumption: < 1.0 W
- Total Harmonic Distortion (THD): < 20% at 40 W
- Inrush Current: < 2 A
- Inrush Current Limiting Circuitry: eliminates circuit breaker tripping, switch arcing and relay failure.
- Open circuit protected
- Short circuit protected
- Turn-on time: ≤ 1 second
- PWM Dimming Frequency: 550 Hz

Environmental

- Sound Rating: Class A.
- Relative Humidity: Maximum 90% non-condensing.
- Minimum operating ambient temperature $t_a = 32$ °F (0 °C).

Standards

- Meets ANSI C62.41 category A surge protection standards up to and including 4 kV.
- FCC Part 15 compliant for commercial applications at 120 V \sim or 277 V \sim .
- Manufacturing facilities employ ESD reduction practices that comply with the requirements of ANSI/ESD S20.20.
- Lutron® Quality Systems registered to ISO 9001.2008.
- UL 8750 recognized.
- Class 2 output available.
- Models available to meet LED Driver requirements for Energy Star 1.1.

Driver Wiring & Mounting

- Driver is grounded by a mounting screw to the grounded fixture (or by terminal connection on the K case).
- Terminal blocks on the driver accept one solid wire per terminal from 18 to 16 AWG (0.75 to 1.5 mm²).
- Fixture must be grounded in accordance with local and national electrical codes.
- Maximum driver-to-LED light engine wire length is 10 ft (3.0 m).

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

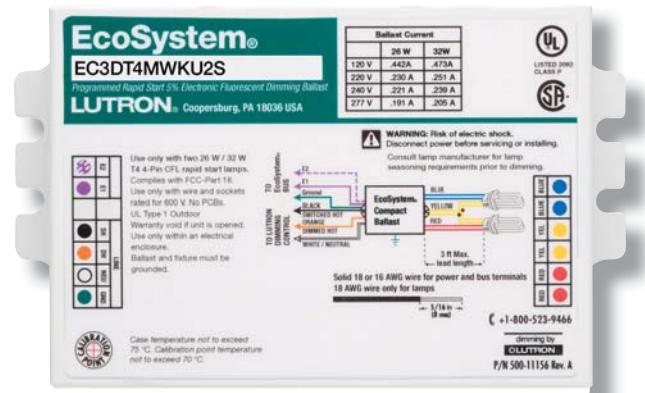
EcoSystem® Digital Ballasts

EcoSystem compact ballasts provide high-performance dimming for any compact fluorescent application, including within an *EcoSystem* Lighting Control System. *EcoSystem* compact ballasts offer 100% to 5% dimming, providing both energy savings and lighting flexibility.

Features

- Continuous, flicker-free dimming from 100% to 5%
- Compatible with *EcoSystem* Energi Savr Node™, GRAFIK Eye® QS with *EcoSystem*, PowPak™ dimming module with *EcoSystem* unit, and Quantum® systems, allowing for integration into an existing/planned *EcoSystem* lighting control system
- Supports standard 3-wire line-voltage phase control technology.
- Programmed rapid start design ensures full-rated lamp life while dimming and cycling.
- Lamps turn on to any dimmed level without flashing to full brightness.
- Low harmonic distortion throughout the entire dimming range.
- Frequency of operation ensures that ballast does not interfere with infrared devices.
- Inrush current limiting circuitry eliminates circuit breaker tripping, switch arcing, and relay failure.
- Ultra-quiet operation.
- Protected from miswires of any input power to control lead, or from lamp leads to each other and/or ground.
- End-of-lamp-life protection circuitry ensures safe operation throughout entire lamp life
- Nonvolatile memory restores all ballast settings after power failure
- 100% compatible with all Lutron 3-wire fluorescent controls and *EcoSystem* digital controls.
- 100% performance tested at factory.
- Custom ballast factors available.

Design tool and specifications can be found at www.lutron.com/ballasttool



EcoSystem ballast, case type K

Job Name:

Model Numbers:

Job Number:

Specifications

Standards

- UL Listed (evaluated to the requirements of UL935)
- UL Type 1 Outdoor for damp locations
- California Energy Commission Listed
- CSA Certified (evaluated to the requirements of C22.2 No. 74)
- Class P thermally protected
- Meets ANSI C82.11 High Frequency Ballast Standard
- Meets FCC Part 18 Non-Consumer requirements for EMI/RFI emissions
- Meets ANSI C62.41 Category A surge protection standards up to and including 4 kV
- Manufacturing facilities employ ESD reduction practices that comply with the requirements of ANSI/ESD S20.20
- Lutron Quality Systems registered to ISO 9001.2008

Performance

- Operating Voltage: 120, 220/240, 277 V~ at 50 or 60 Hz
- Grounding: ballast and fixture must be grounded for proper dimming
- Dimming Range: 100% to 5% measured relative light output
- Lamp Starting: programmed rapid start
- Lamp Current Crest Factor: less than 1.7
- Light Output Variation: Constant $\pm 2\%$ light output for line voltage variations of $\pm 10\%$
- Lamp Life: Average lamp life meets or exceeds specified lamp ratings
- Power Factor: 0.95 minimum
- Total Harmonic Distortion (THD): Less than 10%
- Inaudible in a 27 dBA ambient
- Maximum Inrush Current: 3 A per ballast at 277 V~, 7A per ballast at 120 V~
- Standby power: Less than 1 W

Environment

- Minimum lamp starting temperature: 50 °F (10 °C)
- Relative humidity: less than 90% non-condensing
- Sound Rating: Class A
- Maximum ballast case temperature: 167 °F (75 °C)

Ballast Wiring & Mounting

- Ballast is grounded by the specified terminal or by a mounting screw to the fixture
- Terminal blocks on the ballast accept the following wire gauges:
Power Wiring and *EcoSystem* Bus:
one 16 AWG (1.31 mm²) or 18 AWG (0.82 mm²) solid per terminal
Lamp Wiring:
one 16 AWG (1.31 mm²) or 18 AWG (0.82 mm²) solid per terminal
- Ballast mounts using two mounting tabs or studs within a fluorescent fixture
- Wiring from the ballast to lamp sockets shall not exceed 3 ft (.91 m) for T4 compact lamps
- Ballast does not have sensor terminals

Lamp Seasoning



Refer to lamp manufacturer for lamp seasoning requirements prior to dimming

Warranty

5-year limited warranty with *Lutron* field service commissioning (3-year standard warranty) from date of purchase. For additional Warranty information, please visit <http://www.lutron.com/ResourceLibrary/warranty/Limited%20Comm.pdf>

| | |
|--|------------------------------|
| <p>Job Name:</p> <p>Job Number:</p> | <p>Model Numbers:</p> |
|--|------------------------------|

EcoSystem® Compact Fluorescent Ballast Models

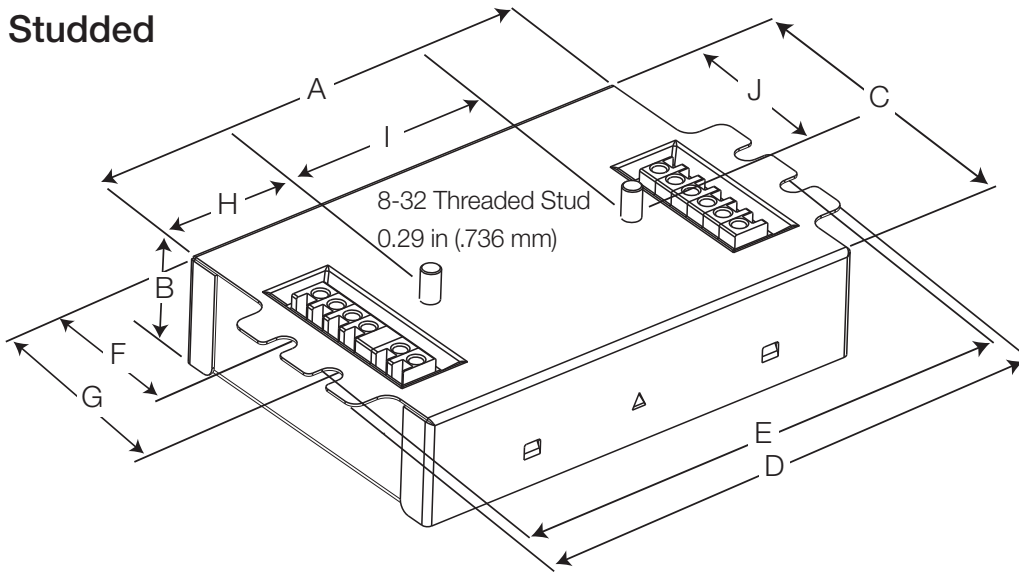
| Lamp Type | Lamp Watts | No. of Lamps | Model | Case Size | Input Voltage (VAC) | Input Current (A) | Input Power (W) | Ballast Factor (BF) | System Lumens (lm) | System Efficacy (lm/W) | Ballast Efficacy Factor | Relative Efficacy (RSE) |
|--|---------------------------|---------------------------|---------------------------|-----------|---------------------|-------------------|-----------------|---------------------|--------------------|------------------------|-------------------------|-------------------------|
| T4 4-Pin Quad-Tube or Triple-Tube  | 18 W | 1 | EC3DT418KU1S (Studded) | K | 120 | 0.18 | 21.3 | 0.95 | 1140 | 53.5 | 4.46 | 0.80 |
| | | | | K | 220 | 0.10 | 21.1 | 0.95 | 1140 | 54.0 | 4.50 | 0.81 |
| | | | EC3DT418KU1 (Non-studded) | K | 240 | 0.09 | 21.4 | 0.95 | 1140 | 53.3 | 4.44 | 0.80 |
| | | | | K | 277 | 0.08 | 20.8 | 0.95 | 1140 | 54.8 | 4.57 | 0.82 |
| | | 2 | EC3DT418KU2S (Studded) | K | 120 | 0.34 | 41.1 | 0.95 | 2280 | 55.5 | 2.31 | 0.83 |
| | | | | K | 220 | 0.18 | 39.6 | 0.95 | 2280 | 57.6 | 2.40 | 0.86 |
| | EC3DT418KU2 (Non-studded) | K | 240 | 0.17 | 39.4 | 0.95 | 2280 | 57.9 | 2.41 | 0.87 | | |
| | | K | 277 | 0.15 | 39.9 | 0.95 | 2280 | 57.1 | 2.38 | 0.86 | | |
| | 26 W | 1 | EC3DT4MWKU1S (Studded) | K | 120 | 0.22 | 26.4 | 0.95 | 1710 | 64.8 | 3.60 | 0.94 |
| | | | | K | 220 | 0.12 | 26.8 | 0.95 | 1710 | 63.9 | 3.55 | 0.92 |
| | | | EC3DT4MWKU1 (Non-studded) | K | 240 | 0.11 | 26.9 | 0.95 | 1710 | 63.7 | 3.54 | 0.92 |
| | | | | K | 277 | 0.10 | 27.0 | 0.95 | 1710 | 63.4 | 3.52 | 0.92 |
| 2 | | EC3DT4MWKU2S (Studded) | K | 120 | 0.43 | 51.6 | 0.95 | 3420 | 66.3 | 1.84 | 0.96 | |
| | | | K | 220 | 0.23 | 49.9 | 0.95 | 3420 | 68.5 | 1.90 | 0.99 | |
| | | EC3DT4MWKU2 (Non-studded) | K | 240 | 0.21 | 50.6 | 0.95 | 3420 | 67.5 | 1.88 | 0.98 | |
| | | | K | 277 | 0.19 | 51.4 | 0.95 | 3420 | 66.6 | 1.85 | 0.96 | |
| T4 4-Pin Triple-Tube  | 32 W | 1 | EC3DT4MWKU1S (Studded) | K | 120 | 0.29 | 34.8 | 0.95 | 2280 | 65.5 | 2.73 | 0.87 |
| | | | | K | 220 | 0.15 | 33.0 | 0.95 | 2280 | 69.1 | 2.88 | 0.92 |
| | | | EC3DT4MWKU1 (Non-studded) | K | 240 | 0.14 | 33.6 | 0.95 | 2280 | 67.9 | 2.83 | 0.90 |
| | | | | K | 277 | 0.12 | 33.2 | 0.95 | 2280 | 68.6 | 2.86 | 0.91 |
| | | 2 | EC3DT4MWKU2S (Studded) | K | 120 | 0.55 | 66.0 | 0.95 | 4560 | 69.1 | 1.44 | 0.92 |
| | | | | K | 220 | 0.29 | 64.5 | 0.95 | 4560 | 70.7 | 1.47 | 0.94 |
| | EC3DT4MWKU2 (Non-studded) | | K | 240 | 0.26 | 63.0 | 0.95 | 4560 | 72.3 | 1.51 | 0.96 | |
| | | | K | 277 | 0.24 | 65.5 | 0.95 | 4560 | 69.7 | 1.45 | 0.93 | |
| | 42 W | 1 | EC3DT442KU1S (Studded) | K | 120 | 0.36 | 43.2 | 0.95 | 3040 | 70.4 | 2.20 | 0.92 |
| | | | | K | 220 | 0.20 | 42.9 | 0.95 | 3040 | 70.8 | 2.21 | 0.93 |
| | | | EC3DT442KU1 (Non-studded) | K | 240 | 0.18 | 42.7 | 0.95 | 3040 | 71.2 | 2.23 | 0.93 |
| | | | | K | 277 | 0.15 | 42.6 | 0.95 | 3040 | 71.3 | 2.23 | 0.94 |
| 2 | | EC3DT442KU2S (Studded) | K | 120 | 0.73 | 87.6 | 0.95 | 6080 | 69.4 | 1.08 | 0.91 | |
| | | | K | 220 | 0.39 | 85.9 | 0.95 | 6080 | 70.8 | 1.11 | 0.93 | |
| | | EC3DT442KU2 (Non-studded) | K | 240 | 0.35 | 85.1 | 0.95 | 6080 | 71.5 | 1.12 | 0.94 | |
| | | | K | 277 | 0.31 | 85.4 | 0.95 | 6080 | 71.2 | 1.11 | 0.93 | |

NOTE: The "S" at the end of the ballast model number indicates a studded option. Remove the "S" for a non-studded ballast.

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

EcoSystem® Compact Fluorescent Ballast Case Dimensions

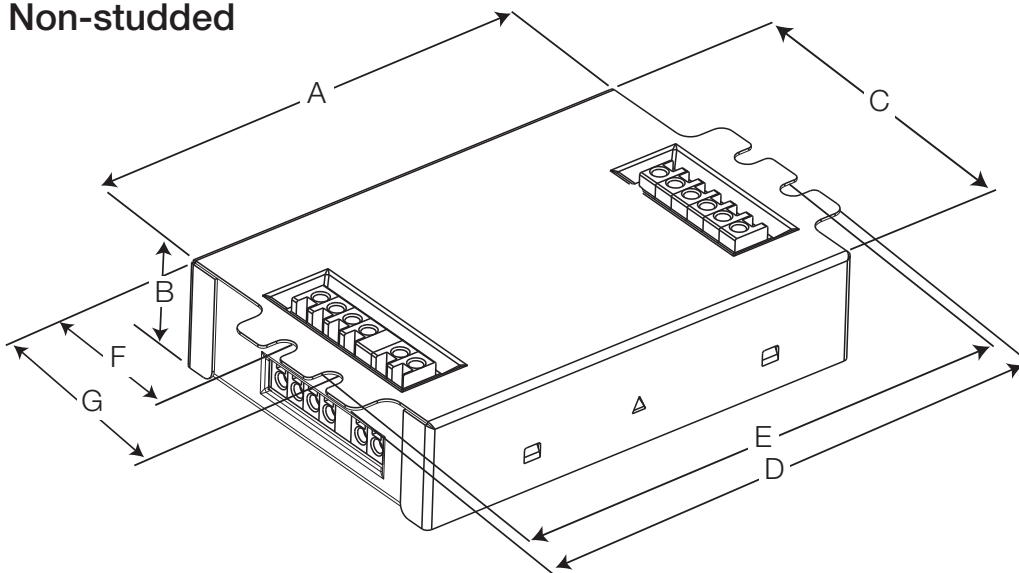
Studded



- A 4.20 in (107 mm)
- B 1.00 in (25 mm)
- C 3.00 in (76 mm)
- D 4.90 in (124 mm)
- E 4.60 in (117 mm)
(mounting centers)
- F 1.42 in (36 mm)
- G 1.99 in (51 mm)
- H 1.09 in (28 mm)
- I 2.00 in (51 mm)
- J 1.60 in (41 mm)

NOTE: Studded version does not have side connectors.

Non-studded

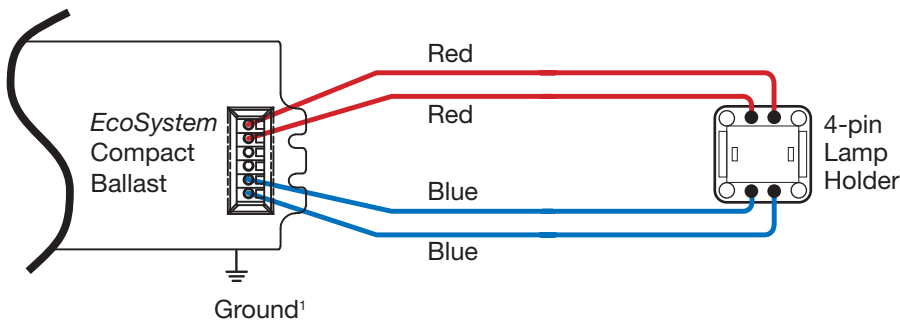


- A 4.20 in (107 mm)
- B 1.00 in (25 mm)
- C 3.00 in (76 mm)
- D 4.90 in (124 mm)
- E 4.60 in (117 mm)
(mounting centers)
- F 1.42 in (36 mm)
- G 1.99 in (51 mm)

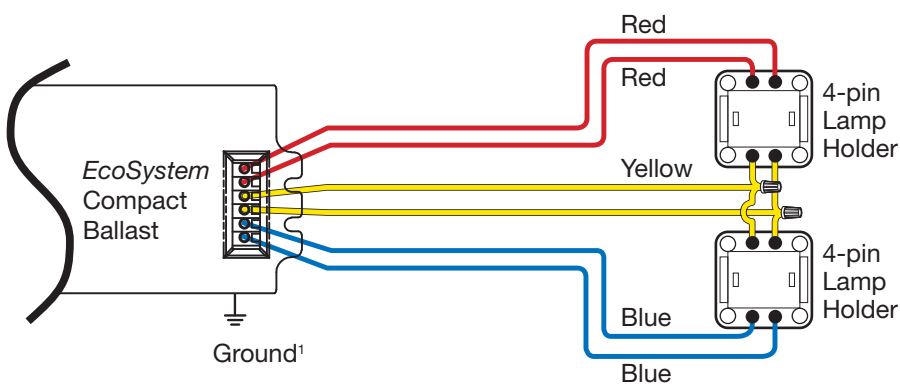
| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Lamp Wiring Diagrams

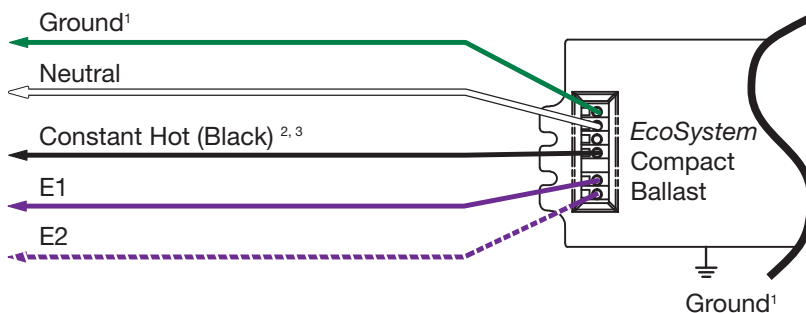
One Compact Fluorescent Lamp



Two Compact Fluorescent Lamps



EcoSystem® Power Wiring Diagrams



¹ Ballast is grounded via the case or terminal.

² Wire colors shown are for Lutron controls and ballasts only. Dimming control wires may not match ballast wire colors.

³ The Constant Hot must not be wired to a switching device.

Note: For T4 compact lamps, maximum lamp-to-ballast wire length is 3 ft (.91 m) to guarantee proper performance.

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

EcoSystem® Bus Wiring Diagrams

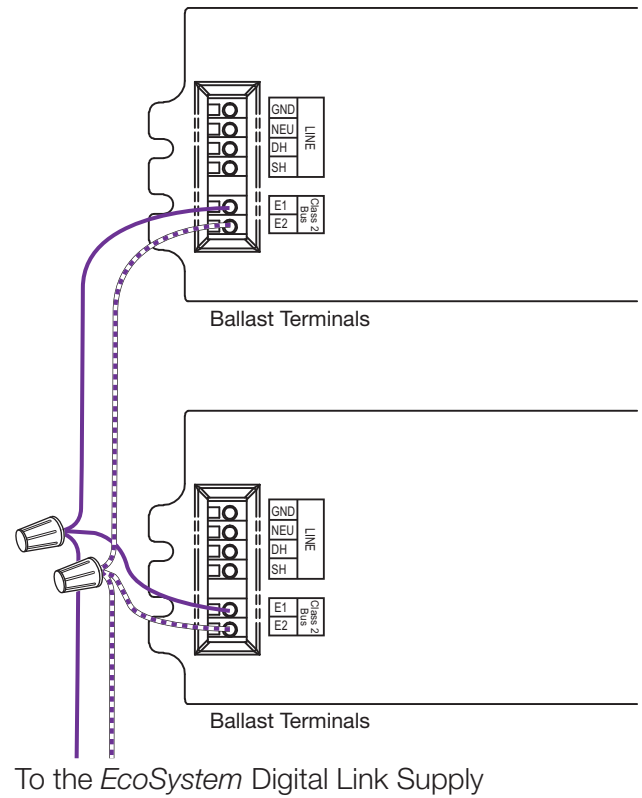
EcoSystem® Digital Link Overview

- The *EcoSystem* Digital Link wiring (E1 and E2) connects the digital ballasts and drivers together to form a lighting control system.
- Each *EcoSystem* Digital Link supports up to 64 digital ballasts or LED drivers, 64 occupant sensors, 16 daylight sensors, and 64 wallstations or IR receivers.*
- Sensors do not directly connect to *EcoSystem* H-Series ballasts.
- No 3-wire phase control with *EcoSystem* H-Series ballasts.
- E1 and E2 (*EcoSystem* digital link wires) are polarity insensitive and can be wired in any topology.
- An Energi Savr Node™ with *EcoSystem* unit, GRAFIK Eye® QS control unit with *EcoSystem*, or Quantum® system provides power for the *EcoSystem* Digital Link and supports system programming.
- All *EcoSystem* Digital Link programming is completed by using the Energi Savr App for an Apple® iPad® or iPhone® mobile digital devices, GRAFIK Eye® QS with *EcoSystem*, PowPak™ dimming module with *EcoSystem*, or *Quantum* System.
- For complete information, see *EcoSystem* Design & Application Guide (P/N 367-1533).

EcoSystem® Digital Link Wiring

- Ballast *EcoSystem* Digital Link terminals only accept one 18 to 16 AWG (0.75 to 1.5 mm²) solid copper wire per terminal.
- Make sure that the supply breaker to the Digital Ballast and *EcoSystem* Digital Link Supply is OFF when wiring.
- Connect the two conductors to the two Digital Ballast terminals E1 and E2 as shown.
- Using two different colors for E1 and E2 will reduce confusion when wiring several ballasts together.
- The *EcoSystem* Digital Link may be wired Class 1 or Class 2. Consult applicable electrical codes for proper wiring practices.

* *PowPak* dimming module with *EcoSystem* can support 32 ballasts or LED drivers.



Notes

- The *EcoSystem* Digital Link Supply does not have to be located at the end of the Digital Link.
- *EcoSystem* Digital Link length is limited by the wire gauge used for E1 and E2 as follows:

| Wire Gauge | Digital Link Length (max) |
|------------|---------------------------|
| 12 AWG | 2200 ft |
| 14 AWG | 1400 ft |
| 16 AWG | 900 ft |
| 18 AWG | 550 ft |

| Wire Size | Digital Link Length (max) |
|----------------------|---------------------------|
| 4.0 mm ² | 828 m |
| 2.5 mm ² | 517 m |
| 1.5 mm ² | 310 m |
| 1.0 mm ² | 207 m |
| 0.75 mm ² | 155 m |

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

EcoSystem® Ballast Wiring: Line Voltage Dimmers

EcoSystem Ballasts and 3-wire dimmers

- Lutron® 3-wire dimmers only control the ballasts they are wired to; EcoSystem ballasts do not support grouping of 3-wire control input.

3-Wire Control Wiring

- Make sure that the supply breaker to the Digital Ballast is OFF when wiring.
- Wire as shown

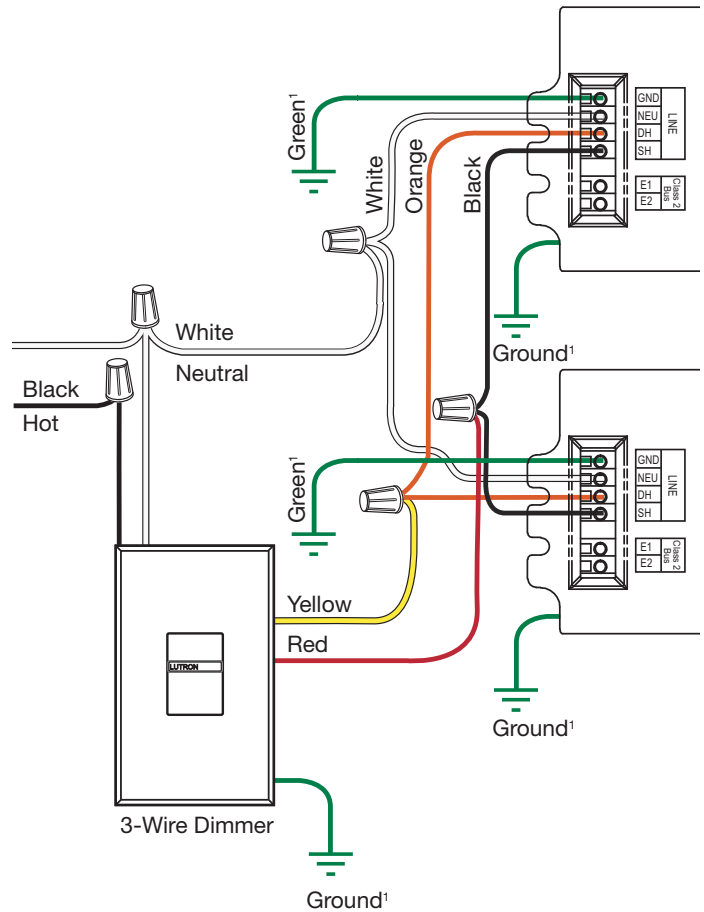
| Line input | Connects to |
|------------|-------------------|
| Hot | Dimmer Black Wire |
| Neutral | Dimmer White Wire |

| Dimmer wire | Connects to |
|-------------|---------------------|
| Yellow | Ballast Orange (DH) |
| Red | Ballast Black (SH) |
| White | Ballast White (NEU) |
| Green | Earth Ground (GND) |

- EcoSystem ballast line voltage and 3-wire input terminals only accept one 16 AWG (1.31 mm²) or 18 AWG (0.82 mm²) solid wire.

Emergency and 3-wire

- EcoSystem ballasts controlled by a wallbox dimmer should not be used for emergency/egress lighting unless an external emergency ballast is used in the fixture. See Lutron App Note #50.
- EcoSystem ballasts may be used for emergency/egress lighting when controlled by a Lutron dimming panel (GP); where the panel is a dedicated emergency panel.



¹ Ballast is grounded via the case or terminal

Notice

3-Wire control turns off digital ballasts when the control is in the off position.

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

ATTENTION ELECTRICIANS AND CONTRACTORS

Ballast/Socket Leads

Lead lengths from ballast to socket must not exceed 7 ft (2 m) for T8, T5, and T5HO linear lamps.

Lamp Sockets

Lamp sockets as per IEC 60400 are required to ensure positive lamp-pin to socket contact.

Lamp Mounting

Many fluorescent lamp sockets are available with mounting slots to vary the height of the lamp away from the grounded metal surface. Use these slots to get the lamp glass to be 1/2 in \pm 1/4 in away from the grounded metal surface for T8 lamps and 3/8 in \pm 1/8 in for T5 and T5HO lamps.

Having a fluorescent lamp too close to the grounded metal will make the minimum intensity too low and will reduce lamp life. Having a fluorescent lamp too far away from the grounded metal will make the lamp flicker or not turn on at all.

Ballast Operating Temperature

Ballast case temperature must not exceed 75 °C at any point on ballast.

Wiring and Grounding

Ballast and lighting fixture must be effectively grounded. Ballasts must be installed per national and local electrical codes.

ATTENTION FACILITIES MANAGERS

PERFORMANCE

Lamp Seasoning

Consult lamp manufacturer's recommendations on lamp seasoning prior to dimming.

SERVICE

Replacement Parts

Use replacement parts with exact Lutron model numbers. Consult Lutron if you have any questions.

Further Information

For further information, please visit us at www.lutron.com/ballasts or contact our 24-hour Technical Support Center at 1-800-523-9466.

| | |
|--|-----------------------|
| <p>Job Name:</p> <p>Job Number:</p> | <p>Model Numbers:</p> |
|--|-----------------------|

Hi-lume Overview

Hi-lume architectural electronic dimming ballasts are designed to meet the most demanding lighting requirements. By providing industry leading performance with true full-range 100% to 1% fluorescent dimming, Hi-lume ballasts enable you to provide the ideal visual environment for any application.

Features

- Continuous, flicker-free dimming from 100% to 1%
- Standard 3-wire line-voltage phase-control technology for consistent fixture-to-fixture dimming performance
- Models available for T4 triple-tube compact and T5-HO linear lamps
- Programmed rapid start design preheats lamp cathodes before applying full arc voltage
- Lamps turn on to any dimmed level without flashing to full brightness
- Low harmonic distortion throughout the entire dimming range maintains power quality
- Frequency of operation ensures that ballast does not interfere with infrared devices operating between 38 and 42 kHz
- Inrush current limiting circuitry eliminates circuit breaker tripping, switch arcing, and relay failure
- End-of-lamp-life protection circuitry ensures safe operation throughout entire lamp life cycle
- For linear lamps, ballasts maintain consistent light output for different lamp lengths, ensuring fixture uniformity
- Ultra-quiet operation
- Protected from miswires of any input power to control lead, or from lamp leads to each other and/or ground
- 100% performance tested at factory
- 5-year limited warranty with Lutron field service commissioning (3-year standard warranty) from date of purchase



Hi-lume, case type A

3.00 in. W (76 mm) x 1.00 in. H (25 mm) x 4.90 in. L (124 mm)



Hi-lume, case type C

1.18 in. W (30 mm) x 1.00 in. H (25 mm) x 18.00 in. L (457 mm)

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Specifications

Performance

- Dimming Range: Hi-lume 100% to 1% measured relative light output (RLO).
- Lamp Starting: programmed rapid start
- Operating Voltage: 120 or 277 V~ at 60 Hz
- Lamp Current Crest Factor: less than 1.7
- Lamp Flicker: none visible
- Light Output Variation: constant ±2% light output for line voltage variations of ±10%
- Lamp Life: average lamp life meets or exceeds rating of lamp manufacturer
- Ballast Factor: greater than .95 for T4 lamps, equal to 1.0 for T5-HO lamps
- Power Factor: greater than .95
- Total Harmonic Distortion (THD): less than 10%
- Maximum Inrush Current: 7 amps per ballast at 120 V, 3 amps per ballast at 277 V~

Environment

- Minimum lamp starting temperature: 50 °F (10 °C)
- Relative humidity: less than 90% non-condensing
- Maximum ballast case temperature: 75 °C (167 °F)
- Sound Rating: Inaudible in a 27 dB ambient

Standards

- UL Listed (evaluated to the requirements of UL935)
- CSA certified (evaluated to the requirements of C22.2 No. 74)
- Class P thermally protected
- Meets ANSI C82.11 High Frequency Ballast Standard
- Meets FCC Part 18 Non-Consumer requirements for EMI/RFI emissions
- T4 and T5-HO ballasts are MIL Std. 461E compliant (meets the requirements of CE101, RE101 and RE102)
- Meets ANSI C62.41 Category A surge protection standards up to and including 6 kV
- Manufacturing facilities employ ESD reduction practices that comply with the requirements of ANSI/ESD S20.20
- Lutron Quality Systems registered to ISO 9001.2000

Ballast Wiring & Mounting



- Ballast is grounded by a mounting screw to the fixture
- Power and lamp wiring terminals accept only one 18 AWG solid wire per terminal

Lamp Seasoning

Refer to the lamp manufacturer’s recommendations for lamp seasoning requirements prior to dimming.

| | |
|--|------------------------------|
| <p>Job Name:</p> <p>Job Number:</p> | <p>Model Numbers:</p> |
|--|------------------------------|

Hi-lume Ballast Models

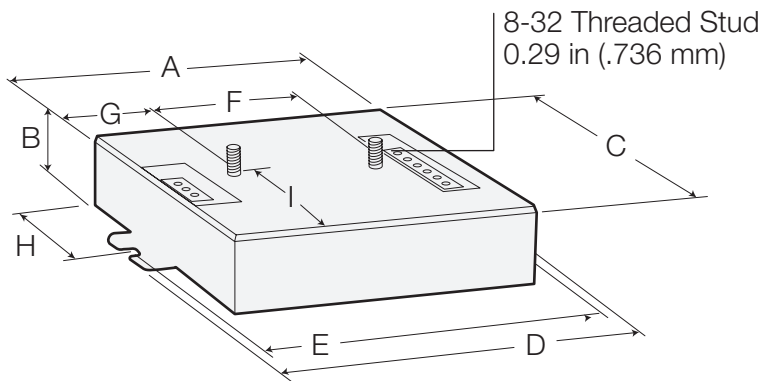
| Lamp Type | | | | 120 VOLTS | | 277 VOLTS | |
|--|---------------------|-------------------|-----------|------------------------|-------------------------------|------------------------|-------------------------------|
| | Lamp Watts (length) | Lamps per ballast | Case Type | Ballast Current (amps) | Hi-lume Model Number | Ballast Current (amps) | Hi-lume Model Number |
| T4 Triple-tube 4-pin  1/2 in. diameter | 26 W | 1 | A | .26 | HL3-T426-120-1-S ¹ | .12 | HL3-T426-277-1-S ¹ |
| | 32 W | 1 | A | .31 | HL3-T432-120-1-S ¹ | .13 | HL3-T432-277-1-S ¹ |
| T5-HO Linear High Output  5/8 in. diameter | 24 W (21.5 in) | 1 | C | .31 | FDB-T524-120-1 | .15 | FDB-T524-277-1 |
| | | 2 | C | .62 | FDB-T524-120-2 | .24 | FDB-T524-277-2 |
| | 39 W (33.4 in) | 1 | C | .38 | FDB-T539-120-1 | .19 | FDB-T539-277-1 |
| | 2 | C | .76 | FDB-T539-120-2 | .32 | FDB-T539-277-2 | |
| | 54 W (45.3 in) | 1 | C | .58 | FDB-T554-120-1 | .25 | FDB-T554-277-1 |
| | | 2 | C | 1.1 | FDB-T554-120-2 | .45 | FDB-T554-277-2 |

¹ Mounting studs standard for T4 ballasts. Delete suffix -S in the model number if mounting studs not needed.

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

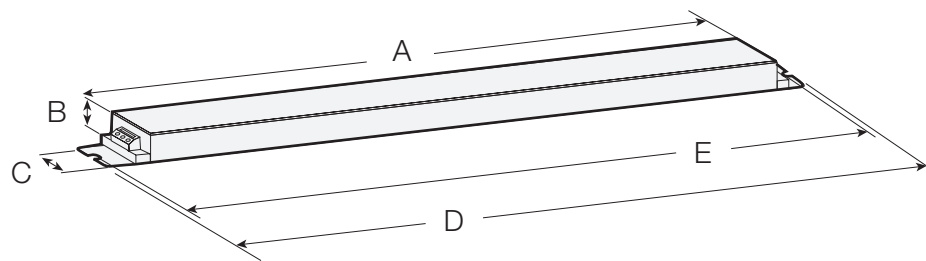
Case Dimensions

A¹



| | |
|---|--|
| A | 4.20 in (107 mm) |
| B | 1.00 in (25 mm) |
| C | 3.00 in (76 mm) |
| D | 4.90 in (124 mm) |
| E | 4.60 in (117 mm) (mounting centers) |
| F | 2.00 in (51 mm) |
| G | 1.08 in (27 mm) |
| H | 1.60 in (41 mm) |
| I | 1.39 in (35 mm) |

C



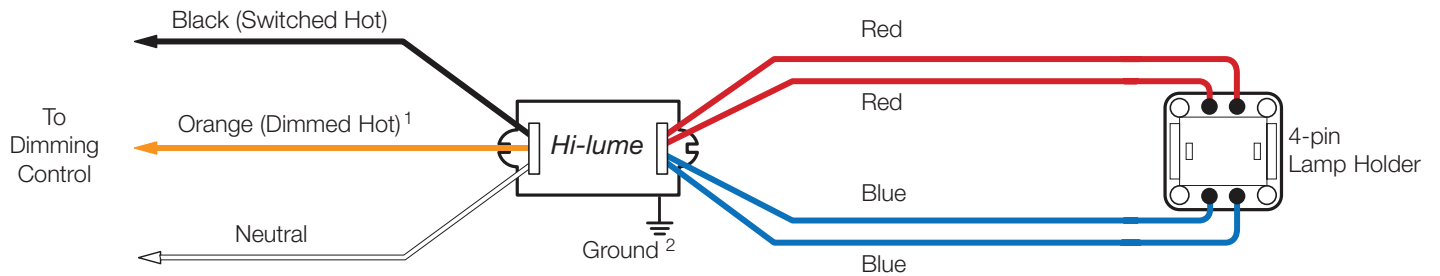
| | |
|---|---|
| A | 16.12 in (409 mm) |
| B | 1.00 in (25 mm) |
| C | 1.18 in (30 mm) |
| D | 18.00 in (457 mm) |
| E | 17.70 in (450 mm) (mounting centers) |

¹ Mounting studs standard. When ordering, delete suffix -S in the ballast model number if mounting studs not needed.

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Wiring Diagram

One Compact Fluorescent Lamp



¹ Dimming control wire colors may not match ballast wire colors (e.g. control “dimmed hot” may be yellow and ballast “dimmed hot” may be orange). Wire colors shown are for Lutron controls and ballasts only.

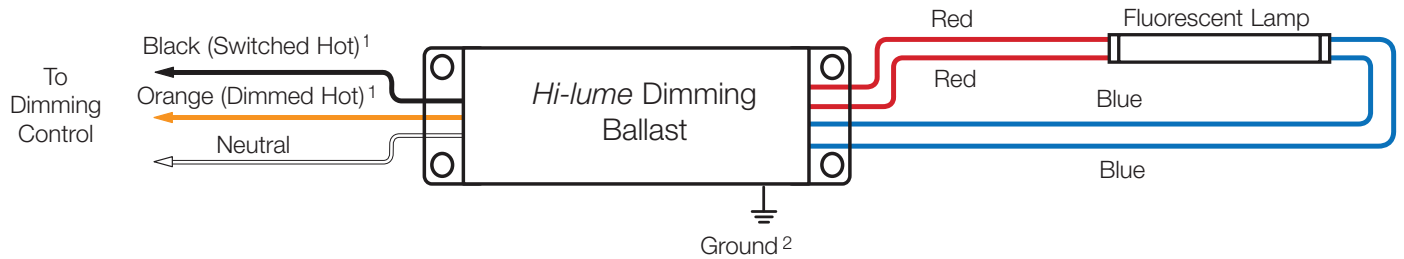
² Ballast and lighting fixture must be grounded.

Note: For T4 compact lamps, maximum lamp-to-ballast wire length is 3 feet (1 m).

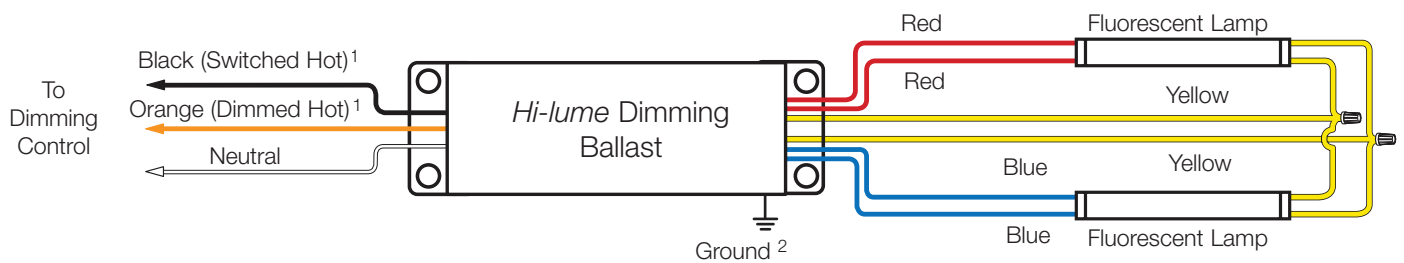
| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Wiring Diagrams

One T5-HO Lamp



Two T5-HO Lamps



¹ Dimming control wire colors do not necessarily match ballast wire colors (e.g. control “dimmed hot” may be yellow, and ballast “dimmed hot” may be orange). Wire colors shown are for Lutron ballasts and controls only.

² Ballast and lighting fixture must be grounded.

Note: For T5-HO lamps, maximum lamp-to-ballast wire length is 7 feet (2 m).

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |



ATTENTION ELECTRICIANS AND CONTRACTORS

Ballast/Socket Leads

Lead lengths from ballast to socket must not exceed 7 ft. (2 m) for T5-HO lamps, and 3 ft. (1 m) for T4 compact lamps.

Lamp Sockets

Lamp sockets as per IEC 60400 are required to ensure positive lamp-pin to socket contact. T5 linear lamps require rotary locking sockets.

Lamp Mounting for T5 and T5-HO

Keep lamps 3/8 in. ± 1/8 in. away from the grounded metal surface.

Having a T5-HO lamp too close to the grounded metal may cause a visible difference in brightness along the length of the lamp.

Ballast Operating Temperature

Ballast case temperature must not exceed 75 °C at any point on ballast.

Wiring and Grounding

Ballast and lighting fixture must be effectively grounded. Ballasts must be installed per national and local electrical codes.



ATTENTION FACILITIES MANAGERS

PERFORMANCE

Lamp Seasoning

Some fluorescent lamp manufacturers recommend that new fluorescent lamps be operated at full output (“seasoned”) before they can be dimmed, to render lamp impurities inert, ensuring proper dimming performance and average rated lamp life. Please contact your lamp manufacturer for seasoning requirements.

SERVICE

Replacement Parts

Use replacement parts with exact Lutron model numbers. Consult Lutron if you have any questions.

Further Information

For further information, please visit us at www.lutron.com/ballasts or contact our 24-hour Technical Support Center at 1-800-523-9466.

| | |
|--|-----------------------|
| <p>Job Name:</p> <p>Job Number:</p> | <p>Model Numbers:</p> |
|--|-----------------------|

Appendix C

Electrical and Controls

GRAFIK Eye 4000 Series Control Unit

Cover (shown open)



Description

- Provides pushbutton recall of four preset lighting scenes, plus Off.
- Allows setup of lighting scenes using buttons on the Control Unit.
- Controls virtually any light source via dimming and switching panels.
- Provides lockout options to prevent accidental changes.
- Includes built-in infrared receiver for operation with an optional remote control.

Models available to:

- Control 2 to 24 zones of lighting.

4000 Series Control Units work with:

- GRAFIK Eye Wallstations
- GP and LP Dimming Panels
- XP Softswitch™ Panels

GRX-4100 Control Units

Provide setup using buttons on the Control Unit.

GRX-4500 Control Units

Provide optional setup using a PC, including setting lighting levels in 1% increments.

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Specifications

Power

- Low-voltage type Class 2 (PELV)
Operating voltage: 24 V Direct Current.

Lighting Sources/Load Types

Controls lighting sources with a smooth, continuous Square Law dimming curve or on a full conduction non-dim basis via GP and LP Dimming Panels and XP Softswitch™ Panels.

Preset Control

- 4 preset lighting scenes and off are accessible from the Control Unit front panel.
- 12 additional scenes are stored in the Control Unit. These scenes are accessible via Wallstations and/or Control Interfaces.
- Light levels fade smoothly between scenes. Fade time can be set differently for each scene, between 0-59 sec. or 1-60 min. Fade time from Off is capped at 5 sec.

Key Design Features

- Meets IEC 801-2. Tested to withstand 15kV electrostatic discharge without damage or memory loss.
- Power failure memory automatically restores lighting to the scene selected prior to power interruption.
- Faceplate snaps on with no visible means of attachment.

System Communications and Capacities

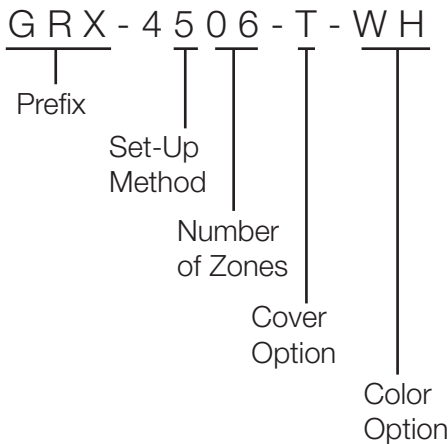
- Low-voltage type Class 2 (PELV) wiring connects Control Units, Wallstations, and Control Interfaces.
- Up to 8 Control Units may be linked to control up to 64 zones.
- Up to 16 total Wallstations and Control Interfaces may be added for a total of 24 control points.

Environment

- 32-104°F (0-40°C). Relative humidity less than 90% non-condensing.

| | |
|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

How to Build a Model Number



Prefix:

GRX for GRAFIK Eye 4000 Series Control Units

Set-Up Method:

- 1 for setup using front panel
- 5 for PC setup

Number of Zones:

2, 3, 4, 6, 8, 16, or 24

Cover Option:

- A for Opaque
- T for Translucent Black

Color Option:

See Color Options list

Cover Options

- Opaque A
Cover and Base will match.
- Translucent Black T
Black Cover and choice of Base color.

Also available:
 - Custom controls
 - Color matching
 - Engraving
 These options ship in 4 to 6 weeks.

Color Options

Architectural Matte Finishes

- Standard – Ship in 48 hours
- Cover Option: A or T
- White WH
- Ivory IV
- Beige BE
- Gray GR
- Brown BR
- Black BL

Designer Gloss Finishes

- Ship in 4 to 6 weeks
- Cover Option: A only
- White GWH
- Ivory GIV
- Light Almond GLA
- Almond GAL

Satin Color Matte Finishes

- Cover Option: A or T
- Hot HT
- Ochre OC
- Terracotta TC
- Desert Stone DS
- Stone ST
- Limestone LS
- Blue Mist BT
- Midnight MN
- Taupe TP
- Biscuit BI
- Eggshell ES
- Snow SW

Architectural Metal Finishes

- Cover Option: T only
- Bright Brass BB
- Bright Chrome BC
- Bright Nickel BN
- Satin Brass SB
- Satin Chrome SC
- Satin Nickel SN
- Antique Brass QB
- Antique Bronze QZ

Anodized Aluminum Finishes

- Cover Option: T only
- Clear CLA
- Black BLA
- Brass BRA
- Bronze BZA

Model Numbers

| Number of Zones | Standard Setup | PC Setup |
|-----------------|----------------|-------------|
| 2 | GRX-4102-__ | GRX-4502-__ |
| 3 | GRX-4103-__ | GRX-4503-__ |
| 4 | GRX-4104-__ | GRX-4504-__ |
| 6 | GRX-4106-__ | GRX-4506-__ |
| 8 | GRX-4108-__ | GRX-4508-__ |
| 16 | GRX-4116-__ | GRX-4516-__ |
| 24 | GRX-4124-__ | GRX-4524-__ |

| | |
|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

LP Dimming Panels

LP Dimming Panels are ideal for projects with many small loads. Each panel provides power and dimming for up to 32 dimming legs.

Features

- Work directly with incandescent, magnetic low voltage, and neon/cold cathode lighting, as well as Lutron TuWire™ Fluorescent Dimming Ballasts.
- Work with electronic low voltage lighting via Power Interfaces.
- Work with 3-wire AC motors through motor modules.
- Panels are prewired - just bring in feed and load wiring.
- Surface or recess mount between 16” center to center studs.

Models available with:

- 100-127 V, 220-240 V (non CE), or 230 V (CE) input power.
- 1 to 8 Dimming Modules for 4 to 32 dimming legs.
- Different feed types and breakers.

LP Dimming Panels work with:

- GRX-4000 Control Units.
- GRAFIK 5000™, GRAFIK 6000®, and GRAFIK 7000® Systems.
- GP Dimming Panels and XP Switching Panels.
- DMX512 dimming systems via the 2LINK™ option.



Standard-Size
LP4/28–LP8/32



Mini
LP1/4–LP3/12

| | |
|---------------------------|------------------------------|
| <p>Job Name:</p> | <p>Model Numbers:</p> |
| <p>Job Number:</p> | |

Specifications

Standards

- UL Listed (Reference: UL File 42071).
- Complies with CSA, NOM, or CE (where appropriate).

Power

- Input power: 100-127 V, 220-240 V (non CE), and 230 V (CE). All voltages 50/60 Hz, phase-to-neutral.
- Branch Circuit Breakers: UL-rated thermal magnetic.
AIC ratings:
100-127 V – 10,000
220-240 V – 6,000
230 V (CE) – 6,000
- Lighting strike protection: Meets ANSI/IEEE standard 62.41-1980. Can withstand voltage surges of up to 6000 V and current surges of up to 3000 A.
- 10-year power failure memory: Automatically restores lighting to scene selected prior to power interruption.

Short Circuit Current Ratings (other ratings available)

| Panel Type | Voltage | Std. SCCR Rating |
|--|---------|------------------|
| LP Main Lug Panels <small>(all sizes)</small> | 120 | 25,000 A |

Sources/Load Types

Operate these sources with a smooth continuous Square Law dimming curve or on a full-conduction non-dim basis:

- Incandescent (Tungsten)/Halogen
- Magnetic Low Voltage Transformer
- Lutron Tu-Wire™ Electronic Fluorescent Dimming Ballasts
- Neon/Cold Cathode

Operate these sources via Power Interfaces:

- Electronic Low Voltage Transformer via dedicated internal Dimming Modules or external Power Interfaces.
- Lutron Electronic Fluorescent Dimming Ballasts via external Power Interfaces.

Operate HID sources on a full conduction non-dim basis.

Dimming Modules

- Each Dimming Module can handle a fully loaded electrical circuit - up to four dimming legs per Module.
- Maximum Ratings:

| Voltage | Capacity per Dimming Module | Capacity per Dimming Leg |
|-----------------------|-----------------------------|--------------------------|
| 100-127 V | 16 A | 16 A |
| 220-240 V (non-CE) | 16 A | 16 A |
| 230 V (CE) | 13 A | 10 A |

- RTISS™ filter circuit technology compensates for incoming line voltage variations: No visible flicker with +/-2% change in RMS voltage/cycle and +/-2% Hz change in frequency/second.

Wiring

- Internal: Prewired by Lutron.
- System communications: Low-voltage Class 2 (PELV) wiring connects Dimming Panels to other components.
- Line (mains) voltage: Feed and load wiring only. No other wiring or assembly required.

Setup

Circuit Selector electronically assigns dimming legs to zones and sources. Permits reassignment of zones and sources without rewiring.

Physical Design

- Enclosure: NEMA-Type 1, IP-20 protection; #16 U.S. Gauge Steel. Indoors only.
- Weight: 27 lb (13 kg) for Mini LP, 63 lb (29 kg) for Standard-Size LP.

Mounting

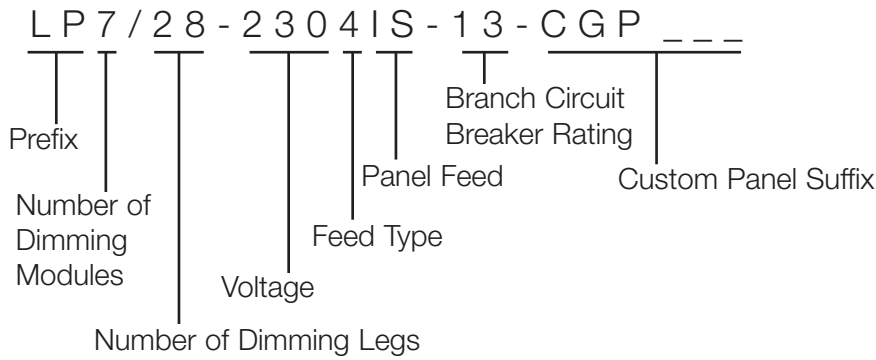
- Surface mount or recess mount between 16 in. (40 cm) studs.
- Allow space for ventilating.

Environment

32-104 °F (0-40 °C). Relative humidity less than 90% non-condensing.

| | |
|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

How to Build a LP Model Number



Prefix:

LP for LP Dimming Panel

Number of Dimming Modules:

Indicates number of dimming modules in the panel.
Also indicates number of full load circuits.

Number of Dimming Legs:

Indicates number of dimming legs in the panel.
Each module has four dimming legs.

Voltage:

- 120 for 100-127 V
- 230 for 230 V (CE)
- 240 for 220-240 V (non-CE)

Feed Type:

- 2 for 1 phase 2 wire
- 3 for 1 phase 3 wire (split phase)
- 4 for 3 phase 4 wire

Panel Feed:

- ML for Main Lugs only
- Mxx for Main Breaker with xx = breaker size in Amps (custom panel option)
- IS for Isolation Switch (CE/non-CE only)

Branch Circuit Breaker Rating:








- 20 for 20 A branch circuit breakers (120 V only)
- 15 for 15 A branch circuit breakers (120 V only)
- 13 for 13 A branch circuit breakers (230 V CE only)
- 16 for 16 A branch circuit breakers (240 V non-CE only)

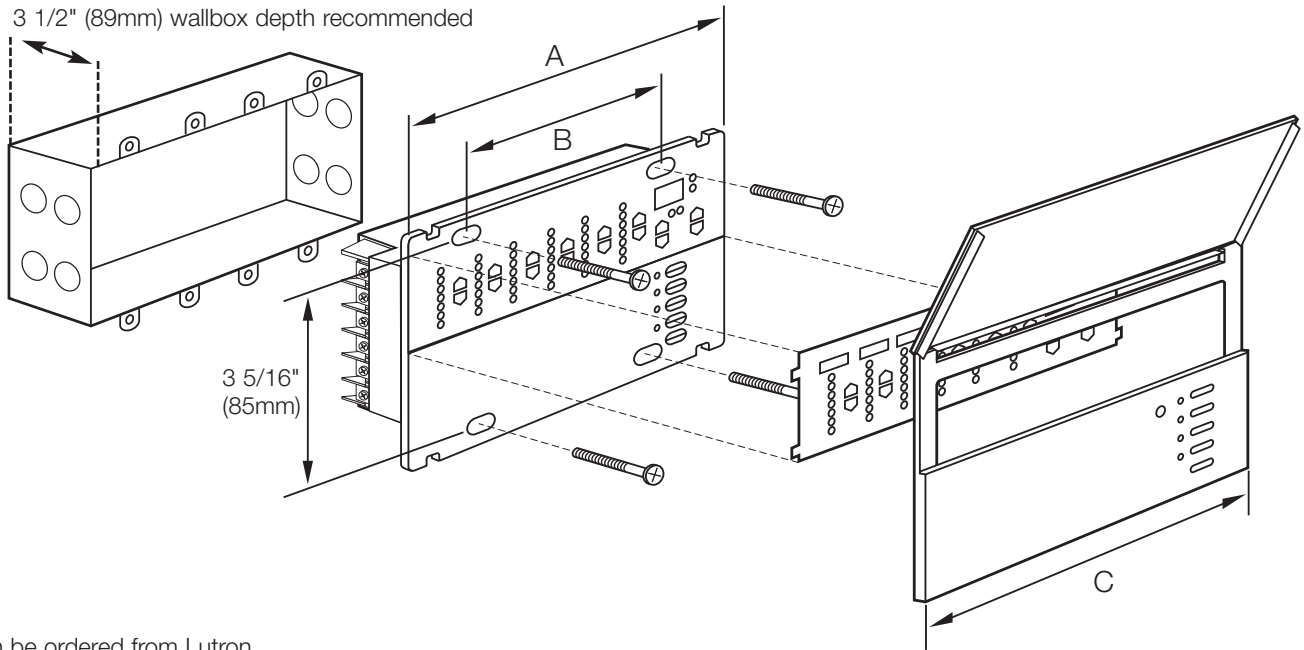
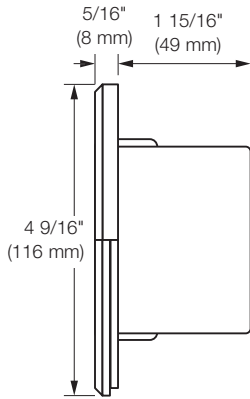
Custom Panel Suffix:

Indicates panel with special options

| | |
|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Dimensions and Mounting

| Model | Side View | A | B | C | Wallbox ¹ U.S. Size | Depth |
|----------------------------------|--|---------------------|--------------------|------------------|-----------------------------------|----------------|
| 2-Zone: GRX-4102 GRX-4502 |  | 4 5/16" (123mm) | 1 13/16" (46mm) | 5.56" (141mm) | 2 Gang | 3.5" (89mm) |
| 3-Zone: GRX-4103 GRX-4503 |  | 6 11/16" (168mm) | 3 5/8" (92mm) | 7.25" (184mm) | 3 Gang | 3.5" (89mm) |
| 4-Zone: GRX-4104 GRX-4504 |  | 8 5/16" (208mm) | 5 7/16" (138mm) | 8.94" (227mm) | 4 Gang | 3.5" (89mm) |
| 6-Zone: GRX-4106 GRX-4506 |  | 8 5/16" (208mm) | 5 7/16" (138mm) | 8.94" (227mm) | 4 Gang | 3.5" (89mm) |
| 8-Zone: GRX-4108 GRX-4508 |  | 8 5/16" (208mm) | 5 7/16" (138mm) | 8.94" (227mm) | 4 Gang | 3.5" (89mm) |
| 16-Zone: GRX-4116 GRX-4516 |  | 8 5/16" (208mm) | 5 7/16" (138mm) | 8.94" (227mm) | 4 Gang | 3.5" (89mm) |
| 24-Zone: GRX-4124 GRX-4524 |  | 8 5/16" (208mm) | 5 7/16" (138mm) | 8.94" (227mm) | 4 Gang | 3.5" (89mm) |



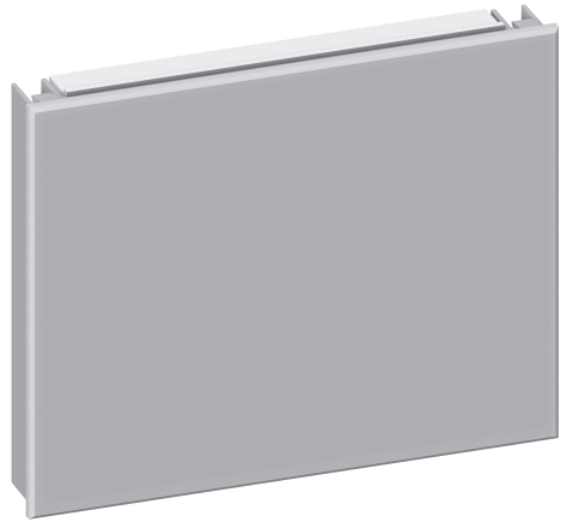
¹ Can be ordered from Lutron.

| | |
|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

3-Wire Fluorescent Power Module

Description

- Provides capability for a zone on a GRAFIK Eye® control unit (or other product) to dim fluorescent lights that have Lutron Hi-lume® and Eco-10® (Eco Series) line-voltage control electronic dimming ballasts.
- Utilizes Softswitch® arcless switching technology.
- Up to 3 power modules may be wired on a single GRAFIK Eye® zone.
- Models available for 120 V~ control power.
- Models available for 120 V~ or 120 - 277 V~ load power.



Works with 120 V~ versions of:

- Lutron 3-wire fluorescent dimmers (consult Lutron for Verti®); see approved list in the dimmers & switches specification guide at www.lutron.com
- GRAFIK Eye® QS control units
- GRAFIK Eye® 3000 Series control units
- LP, LCP, and GP dimming panels
- HomeWorks® and HomeWorks® QS remote power panels

Models and Capacities

| Control Power | Load Power | Capacity | Model Number |
|---------------|--------------|----------|----------------|
| 120 V~ | 120 - 277 V~ | 16 A | PHPM-3F-DV-WH |
| 120 V~ | 120 V~ | 16 A | PHPM-3F-120-WH |

| | |
|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Specifications

Power

- Control voltage: 120 V~
- Load voltage: 120 V~ only for PHPM-3F-120-WH
120 – 277 V~ for PHPM-3F-DV-WH
- Capacity: Full 16 A
120 V~: 1920 W
120 – 277 V~: 1920 – 4432 W
- Frequency: 50 / 60 Hz, phase-to-neutral.
- Load (output) power: Phase independent of control device/control voltage.

Sources/Load Types

- Operates Lutron® Hi-Lume®, Eco-10® (Eco Series), Compact SE™, EcoSystem®, and EcoSystem® Compact line-voltage control electronic dimming ballasts with a smooth continuous Square Law dimming curve.

Key Design Features

- Patented RTISS™ circuitry compensates in real time for incoming line voltage variations: Compensates for +/-2% change in RMS voltage/cycle and +/-2% Hz change in frequency/second.
- Provides air-gap off.
- Module protects itself during temporary over-current conditions on dimmed output.
- Two LEDs on front of unit provide diagnostic information (visible when faceplate is removed).

Terminals

- Accept up to two 12 AWG (2.5 mm²) wires.

Environment

- 32 to 104 °F (0 to 40 °C). Relative humidity less than 90% non-condensing.
- Indoor use only.
- Maximum heat output of module: 15 BTU/hour.

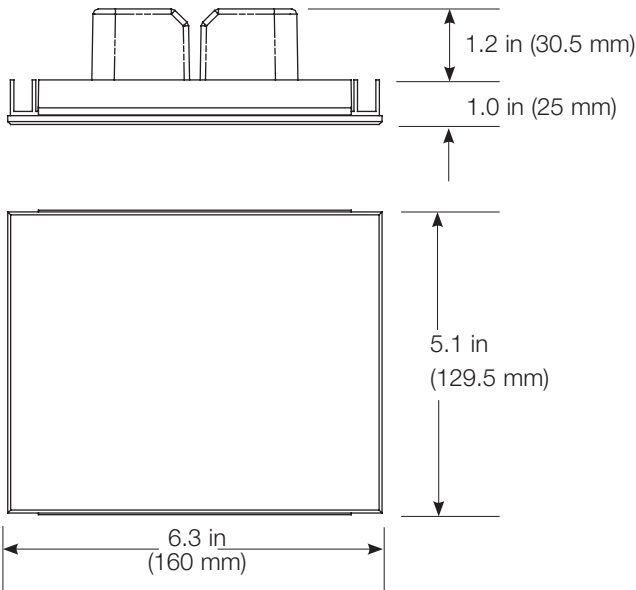
Mounting

- Surface or recess mount.
- Power module is UL tested and approved for use in spaces designed for environmental air handling.

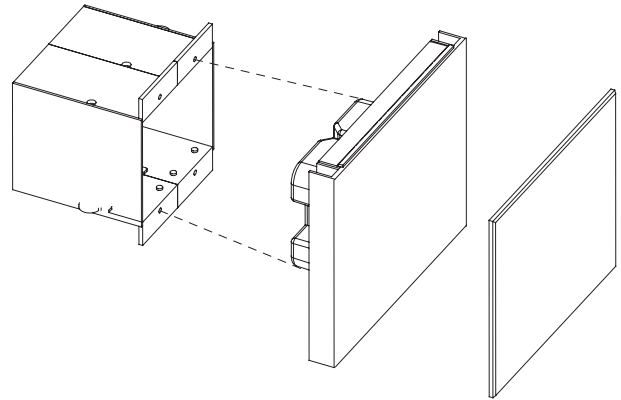
| | |
|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Dimensions and Mounting

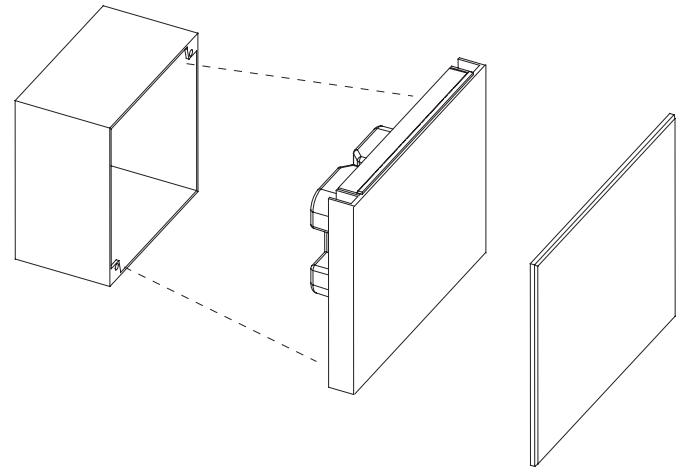
- Mount in 2-gang U.S. wallbox 3.5 in (89 mm) deep or 4 x 4 in (102 x 102 mm) junction box 2.1 in deep (53 mm).
- Indoors only.
- This device generates heat; mount only where ambient temperature is 32 to 104 °F (0 to 40 °C).
- Mount with arrows facing up to ensure adequate cooling.
- Allow 4.5 in (114 mm) above and below unit and between faceplates when mounting several in a vertical layout.
- Mount so line (mains) voltage wiring is at least 6 ft (1.8 m) from sound or electronic equipment and wiring.
- Mount within 7° of true vertical.



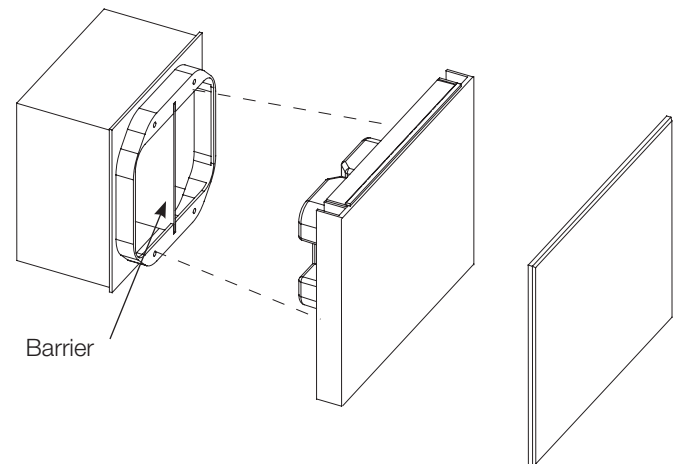
Mount to 2-gang U.S. wallbox



Mount to 4 x 4 in (102 x 102 mm), 2.1 in (53 mm) deep U.S. junction box



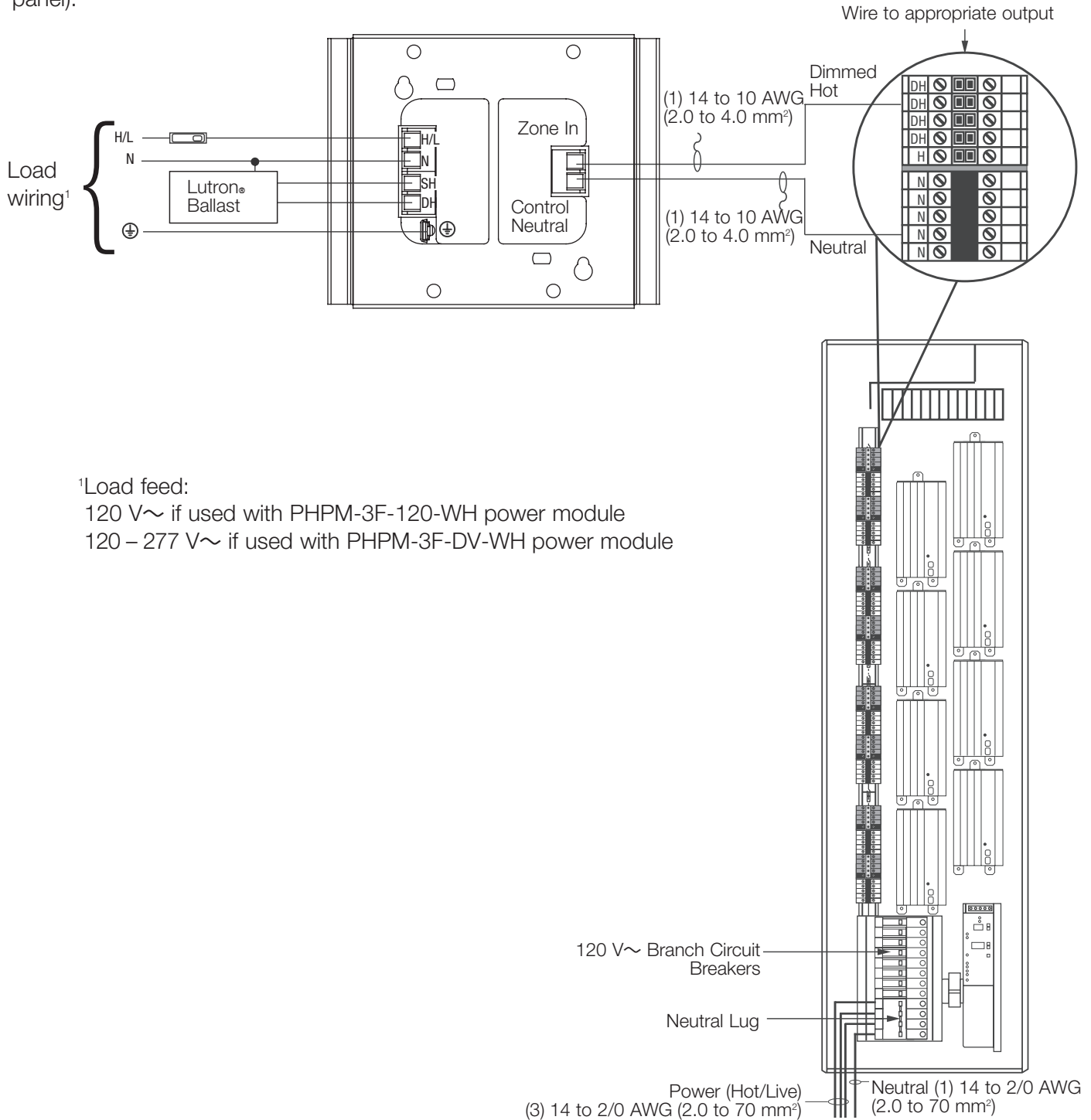
Mount to 4 x 4 in (102 x 102 mm), 2.1 in (53 mm) deep U.S. junction box with barrier (for 277 V~ model if required by local electrical code)



| | |
|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Wiring a Power Module to an LP, LCP, GP, or HomeWorks® Panel

Up to three 3-wire fluorescent power modules may be wired to an output of a 120 V~ LP or LCP panel. The load type for the output must be set as Eco-10® or Hi-lume® fluorescent load type on the panel's circuit selector (for an LP or GP panel), controller (for an LCP panel), or HomeWorks® software (for a HomeWorks® panel).



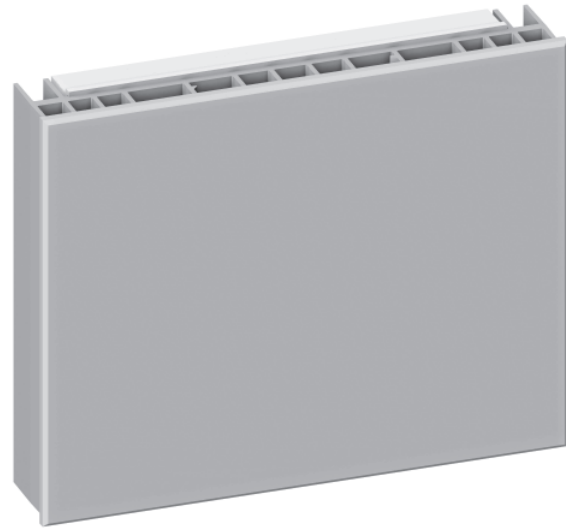
¹Load feed:
 120 V~ if used with PPHM-3F-120-WH power module
 120 – 277 V~ if used with PPHM-3F-DV-WH power module

| | |
|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Phase-Adaptive Power Module

Description

- Provides capability for a zone on a GRAFIK Eye® control unit (or other product) to dim a fully loaded circuit of lighting.
- May be used to control incandescent, electronic low-voltage, magnetic low-voltage, and neon/cold cathode lighting sources, as well as Lutron® Tu-Wire® fluorescent dimming ballasts.
- Automatically selects leading-edge or trailing-edge dimming for low-voltage transformers.
- Provides power and dimming for one zone.
- Up to 3 power modules may be wired on a single GRAFIK Eye® zone.
- Models available for 120 V~ control power.
- Models available for 120 V~ or 120 - 277 V~ load power.
- Not for use with non-dim loads.



Works with 120 V~ versions of:

- GRAFIK Eye® QS control units*
- GRAFIK Eye® 3000 Series control units**
- LP, LCP, and GP dimming panels**
- HomeWorks® and HomeWorks® QS remote power panels**
- Lutron® 3-wire fluorescent dimmers (consult Lutron for Vierti®); see approved list in the dimmers & switches specification guide at www.lutron.com

*Set to power module load type

**Set to incandescent load type

Model and Capacities

| Control Power | Load Power | Capacity | Model Number |
|---------------|--------------|----------|----------------|
| 120 V~ | 120 - 277 V~ | 16 A | PHPM-PA-DV-WH |
| 120 V~ | 120 V~ | 16 A | PHPM-PA-120-WH |

| | |
|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Specifications

Power

- Control voltage: 120 V~
- Load voltage: 120 V~ only for PHPM-PA-120-WH
120 – 277 V~ for PHPM-PA-DV-WH
- Capacity: Full 16 A
120 V~: 1920 W
120 – 277 V~: 1920 – 4432 W
- Frequency: 50 / 60 Hz, phase-to-neutral.
- Load (output) power: Phase independent of control device/control voltage.

Sources/Load Types

- Operates these sources with a smooth continuous Square Law dimming curve:
 - Incandescent (tungsten)
 - Halogen
 - Magnetic low-voltage transformer (iron core)
 - Electronic (solid-state) low-voltage transformer (must be manufacturer approved for reverse-phase control dimming)
 - Neon/Cold cathode
 - Lutron® Tu-Wire® fluorescent dimming ballasts
- Incandescent and electronic low-voltage sources may be controlled on the same circuit/control zone. Up to 30% of the unit's capacity may be used for incandescent lighting.
- Incandescent and magnetic low-voltage sources may NOT be controlled on the same circuit/control zone.
- PHPM-PA not for use with non-dim loads. Use switching power module (PHPM-SW-DV-WH) for non-dim loads.
- Minimum load on power module is 10 W.
- Output must be directly connected to the load. Load side switching is not recommended.

Key Design Features

- Automatically selects between forward phase/leading edge (e.g., magnetic low-voltage) and reverse phase/trailing edge (e.g., electronic low-voltage) dimming/output based on connected load.
- Patented RTISS™ circuitry compensates in real time for incoming line voltage variations: Compensates for +/-2% change in RMS voltage/cycle and +/-2% Hz change in frequency/second.
- Provides air-gap off.
- Module protects itself during most temporary over-current and over-voltage conditions.
- Two LEDs on front of unit provide diagnostic information (visible when faceplate is removed).

Terminals

- Each terminal accepts up to two 12 AWG (2.5 mm²) wires.

Environment

- 32 to 104 °F (0 to 40 °C). Relative humidity less than 90% non-condensing.
- Indoor use only.
- Maximum heat output of module: 135 BTU/hour.

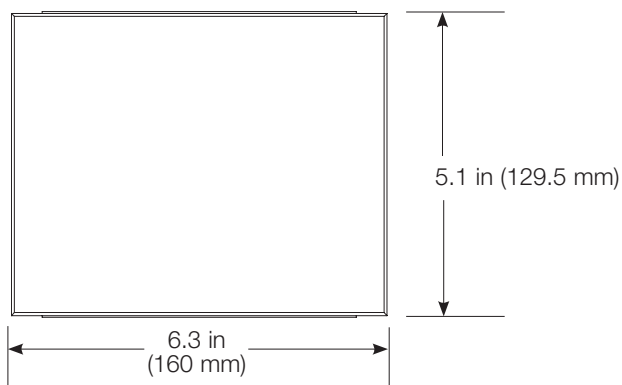
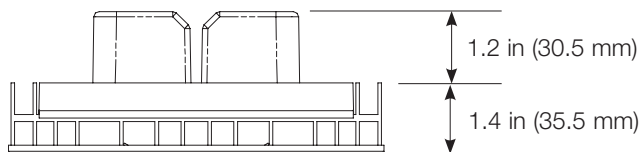
Mounting

- Surface or recess mount.
- Power module is UL tested and approved for use in spaces designed for environmental air handling.

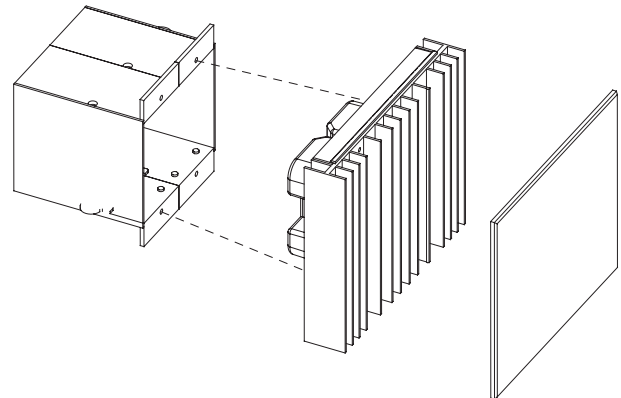
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|--------------------|-----------------------|
| Job Name: | Model Numbers: |
| Job Number: | |

Dimensions and Mounting

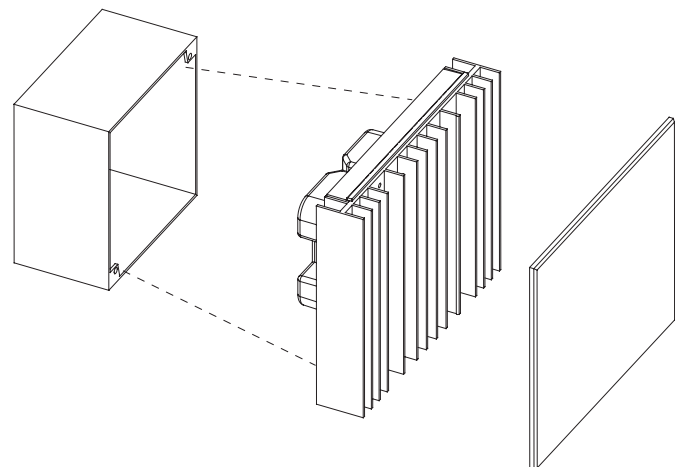
- Mount in 2-gang U.S. wallbox 3.5 in (89 mm) deep or 4 x 4 in (102 x 102 mm) junction box 2.1 in deep (53 mm).
- Indoors only.
- This device generates heat; mount only where ambient temperature is 32 to 104 °F (0 to 40 °C).
- Mount with arrows facing up to ensure adequate cooling.
- Allow 4.5 in (114 mm) above and below faceplates when mounting several modules in a vertical layout.
- Units may butt together when mounted in a horizontal layout.
- Mount so line (mains) voltage wiring is at least 6 ft (1.8 m) from sound or electronic equipment and wiring.
- Mount within 7° of true vertical.



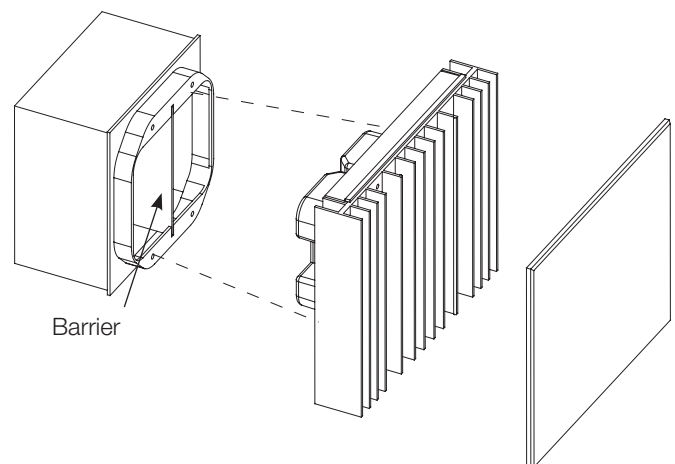
Mount to 2-gang U.S. wallbox



Mount to 4 x 4 in (102 x 102 mm), 2.1 in (53 mm) deep U.S. junction box



Mount to 4 x 4 in (102 x 102 mm), 2.1 in (53 mm) deep U.S. junction box with barrier (for 277 V~ loads if required by local electrical code)



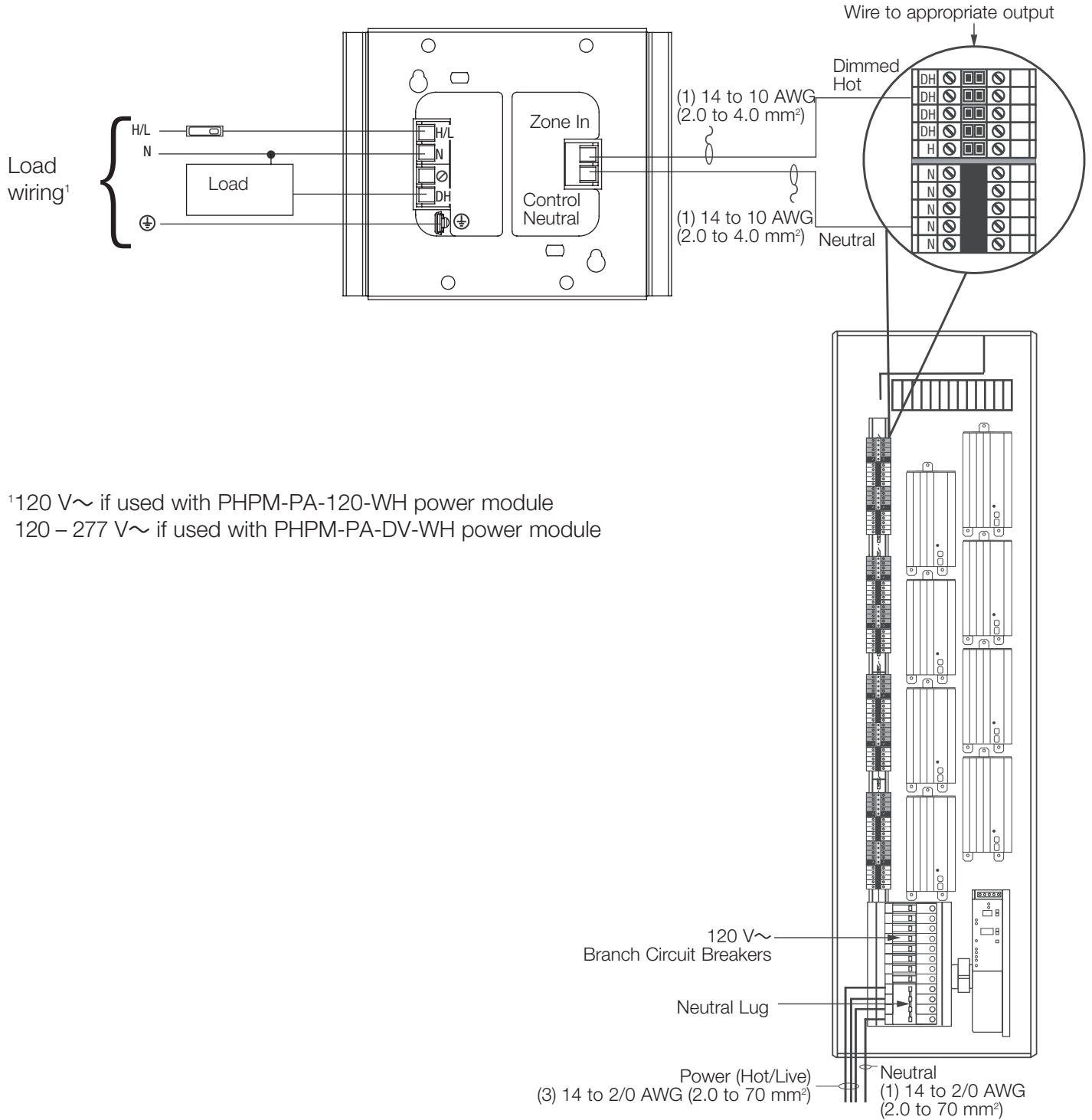
Job Name:

Model Numbers:

Job Number:

Wiring a Power Module to an LP, LCP, GP, or HomeWorks® Panel

Up to three phase-adaptive power modules may be wired to an output of a 120 V~ LP or LCP panel. The load type for the output must be set appropriately on the panel's circuit selector (for an LP or GP panel), controller (for an LCP panel), or HomeWorks® software (for a HomeWorks® panel).



¹120 V~ if used with PHPM-PA-120-WH power module
 120 – 277 V~ if used with PHPM-PA-DV-WH power module

| | |
|-------------|----------------|
| Job Name: | Model Numbers: |
| Job Number: | |