LIGHTING ESSENTIALS FOR A/V PROFESSIONALS

MICHAEL BROUGHTON, SUNY CORTLAND
MICHAEL BROUGHTON

• Former Entertainment Lighting Technician
  • Merry-Go-Round Playhouse & Finger Lakes Musical Theatre Festival
  • Portland Center Stage
  • Freelance in NYC
  • Touring Lighting Supervisor, Moscow Ballet
  • Massachusetts Museum of Contemporary Art (MassMOCA)
SUNY CORTLAND’S SESQUICENTENNIAL CELEBRATION
DESIGN CONSIDERATIONS

• What are the controllable properties of light?
  • Intensity
  • Angle
  • Color
  • Distribution
  • Movement
INTENSITY — HOW BRIGHT IS THE LIGHT?

• Lighting sources can be measured in lumens.

• The amount of light on a subject can be measured in footcandles or lux.
  • For lighting a person giving a speech or presentation on a stage, I use a rough goal of 75 footcandles.
SUMMARY
The 5°, 10°, 19°, 26°, 36° and 50° fixed focus PHX LED ellipsoids are state of the art luminaires in function, style, and efficiency. These ellipsoids have been designed and engineered with a number of innovative details and features enhancing versatility and efficiency without sacrificing performance.

A diverse line of LED choices are available in 250 watt RGBA, RGBW, 3000k, 5600k, and tunable white 3000K/5600K.

Fully locking shutters and a 360° rotating barrel help keep your keep the artistic part of your fixtures focus intact and easy to attain, and with virtually no light leak from the fixture itself you won't have to worry about any extra light illuminating unwanted parts of the ceiling. The aesthetic appearance and ergonomically designed function controls only add to the appeal.

These new and innovative options are what makes the PHX LED ellipsoids ideal for theatres, Special Events, television studios, or wherever superior, energy efficient lighting performance is required.

FEATURES
- 360 degree rotating barrel
- Locking Shutters
- Completely enclosed accessory holder
- Heat resistant Plano-Convex lensing
- Die cast aluminum and sheet metal fabrication
- Color frame, C-Clamp, Soft Focus Pattern holder
- Safety cable, 5 Foot PowerCON included
- Carries standard three year Altman Warranty
- Tool free interchangeable barrels
- 26.5 lbs. (12kgs)
- ETL, cETL, & CE listed
- Assembled in the USA
### RGBA PERFORMANCE

#### 5 Degree

<table>
<thead>
<tr>
<th>Beam Size Diameter (d)</th>
<th>20&quot;</th>
<th>30&quot;</th>
<th>40&quot;</th>
<th>50&quot;</th>
<th>60&quot;</th>
<th>70&quot;</th>
<th>80&quot;</th>
<th>90&quot;</th>
<th>100&quot;</th>
<th>110&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam Size Diameter</td>
<td>0.73m</td>
<td>1.08m</td>
<td>1.46m</td>
<td>1.82m</td>
<td>2.19m</td>
<td>2.56m</td>
<td>2.92m</td>
<td>3.29m</td>
<td>3.65m</td>
<td>4.02m</td>
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<tr>
<td>Illuminance (lux)</td>
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<td>333.44</td>
<td>188.69</td>
<td>120.76</td>
<td>82.96</td>
<td>56.81</td>
<td>41.87</td>
<td>37.27</td>
<td>30.13</td>
<td>26.10</td>
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<tr>
<td>Illuminance (fc)</td>
<td>(8324.05)</td>
<td>(3610.69)</td>
<td>(2031.03)</td>
<td>(1299.84)</td>
<td>(962.07)</td>
<td>(665.18)</td>
<td>(507.70)</td>
<td>(401.03)</td>
<td>(324.96)</td>
<td>(264.56)</td>
</tr>
</tbody>
</table>

#### 10 Degree

| Beam Size Diameter     | 0.91m | 1.37m | 1.82m | 2.28m | 2.74m | 3.20m | 3.65m | 4.11m | 4.57m | 5.03m |
| Illuminance (lux)      | 455.00 | 202.22 | 113.75 | 72.80 | 50.56 | 37.14 | 26.44 | 21.47 | 16.20 | 12.04 |
| Illuminance (fc)       | (4897.57) | (2175.70) | (1226.39) | (795.64) | (514.17) | (399.48) | (301.69) | (242.47) | (182.65) | (138.03) |

#### 19 Degree

| Beam Size Diameter     | 1.19m | 1.74m | 2.29m | 2.84m | 3.39m | 3.94m | 4.49m | 5.04m | 5.59m | 6.14m |
| Illuminance (lux)      | 491.00 | 218.22 | 122.75 | 78.56 | 54.56 | 40.08 | 30.69 | 24.30 | 19.60 | 15.69 |
| Illuminance (fc)       | (5205.81) | (2348.92) | (1321.88) | (845.63) | (587.23) | (431.68) | (334.00) | (263.28) | (210.53) | (167.84) |

#### 26 Degree

| Beam Size Diameter     | 1.48m | 2.06m | 2.64m | 3.22m | 3.80m | 4.38m | 4.96m | 5.54m | 6.12m | 6.70m |
| Illuminance (lux)      | 250.00 | 113.11 | 62.50 | 40.00 | 27.78 | 20.41 | 15.63 | 12.35 | 10.00 | 8.26 |
| Illuminance (fc)       | (2690.07) | (1195.98) | (672.74) | (403.55) | (298.95) | (219.67) | (168.18) | (132.88) | (107.68) | (89.95) |

#### 36 Degree

| Beam Size Diameter     | 1.77m | 2.35m | 2.93m | 3.51m | 4.09m | 4.67m | 5.25m | 5.83m | 6.41m | 7.00m |
| Illuminance (lux)      | 156.00 | 69.33 | 35.00 | 24.96 | 17.33 | 12.73 | 9.75 | 7.70 | 6.24 | 5.16 |
| Illuminance (fc)       | (1679.16) | (746.29) | (419.79) | (260.66) | (186.57) | (137.07) | (104.94) | (82.52) | (67.16) | (55.50) |

#### 50 Degree

| Beam Size Diameter     | 2.05m | 2.63m | 3.21m | 3.79m | 4.37m | 4.95m | 5.53m | 6.11m | 6.69m | 7.27m |
| Illuminance (lux)      | 88.00 | 39.11 | 22.00 | 14.08 | 9.78 | 7.18 | 5.50 | 4.35 | 3.52 | 2.91 |
| Illuminance (fc)       | (947.22) | (420.95) | (236.05) | (153.55) | (105.24) | (77.32) | (55.20) | (44.77) | (37.88) | (31.31) |

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Note: All measurements are RGBA on at full intensity.
ANGLE

THE ANGLE AT WHICH THE LIGHT IS HITTING THE SUBJECT

Textbook front light is 45 degrees up and 45 degrees to each side.
COLOR

- Color Temperature is measured in Kelvin

<table>
<thead>
<tr>
<th>Warm White</th>
<th>Daylight White</th>
<th>Cool White</th>
</tr>
</thead>
<tbody>
<tr>
<td>2700K-3300K</td>
<td>4200-4500K</td>
<td>5500-7000K</td>
</tr>
</tbody>
</table>
COLOR TEMPERATURE CONSIDERATIONS

• Warmer light has a calming effect. A nice restaurant would probably aim for ~2,700K.

• Cooler light is ideal for learning or analysis. Studies recommend ~5,000K lighting in classrooms.

• I tend to avoid using a lot of blue or green around food, especially meat.
DISTRIBUTION

• Where is the light?
• Where isn’t there light?
MOVEMENT

• Are the lights themselves moving?
• Are the lights changing?

CONSIDERATIONS

• Eyes are drawn to movement
• Often, but not always, used with music
PUTTING IT ALL TOGETHER
PAR 56 & 64/AL

Altman PARs are low-cost, highly flexible luminaires designed for diverse applications. Intensities and beam spread are a function of the installed light source, so any one unit can serve multiple purposes simply by changing the lamp type.

The smaller size of the PAR56 reduces installation hassles, while the PAR64’s optional PAR56/64 adapter ring gives the fixture great versatility. With oval beams and lamp ranges from 300 to 500 watts for the PAR56 and 300 to 1000 watts for the PAR64, these lights are ideal for use in concerts, nightclubs, television and film remotes and architectural applications where maximum flexibility is desired in a small, compact package.

The PAR64-AL is a PAR64 unit constructed from .050-gauge rolled aircraft aluminum to minimize weight without sacrificing durability.

300-500 WATT PAR 56
300-1000 WATT PAR 64 & PAR 64-AL

Features
- Constructed of rugged sheet steel (PAR56/64) or rolled aircraft aluminum (PAR64-AL)
- 360° lamp rotation
- Hinged rear cover for easy lamp access
- Spring loaded accessory holder safety latch
- Mogul-end prong socket
- Three position yoke adjustment
- Three 30° Teflon lead wires
- Color frame, wire mesh safety screen and safety cable with spring clip included
- UL and cUL listed for 500 Watts (PAR56) or 1000 Watts (PAR64/AL)
- Made in the USA

<table>
<thead>
<tr>
<th>Model</th>
<th>Lamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR64-AL</td>
<td>90-300PAR56NSP</td>
</tr>
</tbody>
</table>

See following pages for dimensions

Project: Approval Date:
Location: Fixture Type:

ALTMAN Lighting
BRINGING IMAGINATION TO LIGHT

© 2012 Altman Stage Lighting, Inc. Tel: 914-476-7987 Visit our website at www.altmanlighting.com
Specifications:

- **Materials:** Construction employs all corrosion-resistant materials and hardware.
- **Housing:** Spun, rolled, and stamped steel (PAR56, PAR64 or aluminum (PAR56-AL)).
- **Yoke:** Rigid flat steel for PAR56 and PAR64, rigid flat aluminum for PAR56-AL.
- **Socket:** Mogul end prong. Tool free remapping.
- **Rating:** 120–240V AC/DC, 4.2/2.1 amps, 500 watts maximum for PAR56, 834.2 watts, 1000 watts maximum for PAR56 and PAR64-AL.
- **Cable:** 35°F braid lead, encased in black sheathing.

Focus:

- **Lamp can be rotated 360°.**

Accessories:

- **Standard 7.5" x 7.5" accessories for PAR56. 10" x 10" accessories for PAR64 and PAR56-AL.** Wire mesh safety screen included for PAR56, PAR64 and PAR56-AL.

Finish:

- **Black epoxy sandblasted, electrostatic application.** (PAR64 and PAR56) or brushed aluminum finish outside, flat black birem忠诚 inside (PAR56-AL).

Weight:

- **Approx. 9 lbs. (4.1 kg) for PAR56; approx. 11 lbs. (5.0 kg) for PAR64; approx. 12 lbs. (5.6 kg) for PAR56-AL.**

Lamps:

<table>
<thead>
<tr>
<th>Name</th>
<th>ANL code</th>
<th>Order code</th>
<th>Color temp.</th>
<th>Ra/NFL</th>
<th>Rated Lumens</th>
<th>Beam spread</th>
<th>Condalpower</th>
<th>Beam angle</th>
<th>Field angle</th>
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<tr>
<td>50W</td>
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<td>PAR56</td>
<td>3000</td>
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<td>150</td>
<td>141°</td>
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<tr>
<td>50W</td>
<td>PAR64</td>
<td>PAR64</td>
<td>3000</td>
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<td>150</td>
<td>141°</td>
<td>1100</td>
<td>150°</td>
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<td>141°</td>
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Photometrics:

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<th>400</th>
<th>500</th>
<th>600</th>
<th>700</th>
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<td>FOV</td>
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<td>80°</td>
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<td>Center beam ft.</td>
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<td>200</td>
<td>250</td>
<td>300</td>
<td>350</td>
<td>400</td>
<td>450</td>
<td>500</td>
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<td>w/T</td>
<td>150</td>
<td>220</td>
<td>270</td>
<td>320</td>
<td>370</td>
<td>420</td>
<td>470</td>
<td>520</td>
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**Note:** All figures are approximate and may vary slightly. Always consult the manufacturer's specifications for the most accurate information.
## Photometrics:

<table>
<thead>
<tr>
<th>Distance</th>
<th>Lamp</th>
<th>Center beam fc</th>
<th>10'</th>
<th>20</th>
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<td>ht.(')</td>
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<tr>
<td>1000</td>
<td>90-300PAR56/NSP</td>
<td>700</td>
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<td>3.5</td>
<td>6.3</td>
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</table>
Opti Tri Par

The Opti Tri Par by Elation Professional is a RGB tri color LED par featuring 18 tri RGB running at 3W power each. The design of the fixture is optimized providing up to 50,000 hours estimated LED life, 70W power consumption, fan cooled and flicker free operation. The Opti Tri Par is operable via 6 DMX channel modes: 1, 2, 3, 4, 6, and 7. This unit produces a standard beam angle of 25° and is rated IP 20, ideal for indoor applications. Control data input is via 5 pin DMX data first in and out connections. This unit is fully operational in any mounting position. Other features include electronic power supply, five operating modes and user may daisy chain units together in DMX mode. Gel frame is included and rigging for this unit includes single yoke bracket, safety and data cable are optional.

FEATURES
- Tri-Color LED Par
- ETL Approved Fixture
- DMX intelligent 3-in-1 RGB LED wash
- 18 x 3W LEDs
- 25° standard beam angle
- Rated IP 20
- Case Color: Black
- Cooling: Fan Cooled
- Electronic power supply
- 4 Digit LED display
- DMX controllable via 6 DMX modes: 1, 2, 3, 4, 6, & 7
- Macros: Yes
- Gel Frame included
- Master/Slave
- On Board Control
- Stand Alone
- Flicker Free

TECHNICAL SPECIFICATIONS
- DMX Channels: 6 DMX modes: 1, 2, 3, 4, 6, & 7
- Control: USITT DMX-512, 5 pin XLR data input & output
- Dimmer: Master Dimmer (7 ch mode)
- Strobe: Strobe effect (1-18 flashes per second)
- IP Rating: IP 20
- Power Supply: 90 - 240v, 50/60Hz
- Power Consumption: 70W
- Ballast: Electronic
- Cable / Plug Type: PPG 120v US
- Approvals: CE Approved - ETL Approved
- Lamp: SSC-Tri RGB, 18 x tri RGB, 18 x 3W LEDs
- Lamp Life: 50,000 hrs. life
- Lux: 350 Lux @ 3M
- Dimensions: (L x W x H) 11.5" x 8.5" x 8.5" / 292.1 x 215.9 x 215.9mm
- Weight: 11 lbs / 4.9 kg
- Rigging: Split Yoke Bracket / safety and data cable optional
SYSTEM SETUP

• Control Protocols
  • DMX
  • Art-Net, sACN

• Controllers

• Dimming

• Power
DMX CONTROL

• Initially developed to standardize control of dimmers
• Based on RS-485
• Unidirectional – no feedback from fixtures
• One DMX Universe contains 512 channels, each can have a value of 0-255
• Fixtures or dimmers are addressed with a channel which they will respond to
  • This is a “start” channel, but devices will typically use more than one channel
• Daisy-chainable, no Y cables
  • The only way to split a DMX signal is with an optical splitter
• Max ~1,000 ft total run, ~300 feet between devices
DMX OVER ETHERNET

• Art-Net
  • Control up to 32,768 DMX universes over Ethernet

• sACN
  • Control up to 63,999 DMX universes over Ethernet

• Some fixtures will directly connect via Ethernet and can use these protocols, but typically a node is used.
DMX CONTROLLERS

• Consoles
  • Professional
    • Theatrical
      • ETC, Strand
    • Concerts
      • High End Systems, MA Lighting, Martin, Chamsys.
  • DJ
    • Elation, American DJ, Chauvet

• Apps
  • Luminair, Aurora DMX
Luminair App

ETC Element 2
DIMMING

- Incandescent fixtures are controlled using dimmers.
- DMX and power input, variable power output.
- Commonly available from 1 channel to 96 channels.

Elation Uni-Bar
Single Channel

Leprechaun ULD-360
6 Channel

ETC Sensor3
48 Channel
POWER

• Incandescent lighting uses a lot of power
  • Par Cans from earlier = 500 watts each
  • 500 x 4 = 2,000 watts

• Typical 20 amp branch circuit should not see a constant load more than 80%

• 20 amp @ 120v = 2,400 watts. 80% x 2,400 watts = 1,920 watts max.

• LED is much more efficient, but you still must be careful.
• Extension Cords
  • “Cheap orange” cords often 16 gauge.
  • 16 gauge typically rated 10 amps
  • 14 gauge typically rated 15 amps
  • 12 gauge typically rated 20 amps

• Derate with distance
COST CONSIDERATIONS

VERY ROUGH BUDGET PRICING FOR 2-3 DAYS RENTAL

• LED LIGHTING FIXTURES WIRED/WIRELESS BUDGET $35/EACH
• CABLES $5/EACH
• CONTROLLER $100-$200

ACTUAL COST – SUNY CORTLAND SESQUICENTENNIAL

• WIRED PACKAGE (28 LIGHTS, CABLES, TAPE, ETC, NO CONTROLLER = $1,150
• WIRELESS PACKAGE (30 LIGHTS) = $690
TOTAL = $1,840
QUESTIONS?