

## Designers Light Forum

# **Dr. StrangeLED, or: How I Learned to Stop Worrying and Love the LED**

Kenny Schutz, LC, IES, PMP



March 13, 2018



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material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

# Learning Objectives

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At the end of the this course, participants will be able to:

1. Identify the new challenges and complexities LEDs present for designers, installers, owners, and maintenance staffs.
2. Understand: "What do LEDs require of us?" to ensure successful outcomes.
3. Learn specific strategies to overcome common problems the arise from specifying and installing LEDs.
4. What and how to communicate with project stakeholders (especially owners and maintenance staffs) to preserve the project for the long term.

# How I Learned to Stop Worrying and Love the LED



Full Disclosure...

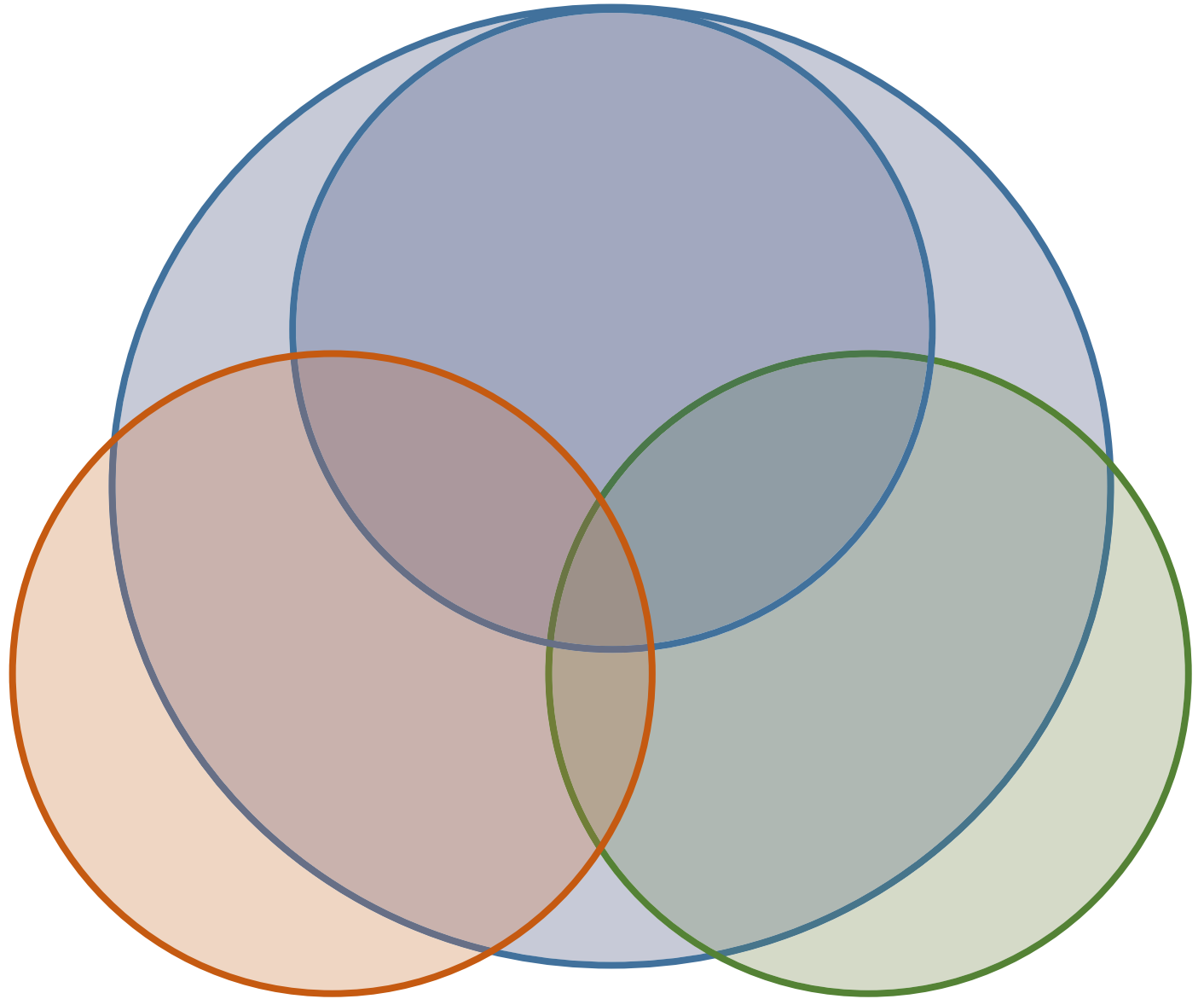


I *don't* love  
LEDs...

# Who's Problem?

- Specifiers
- **Installers**
- Maintenance

- Manufacturers
- Reps
- Distributors



# What are the Challenges?



# What are the Challenges?

- Complexity
- Failures, Replacements, and Consistency
- Maintenance
- Flicker & Dimming...
- Drivers
- Value Engineering

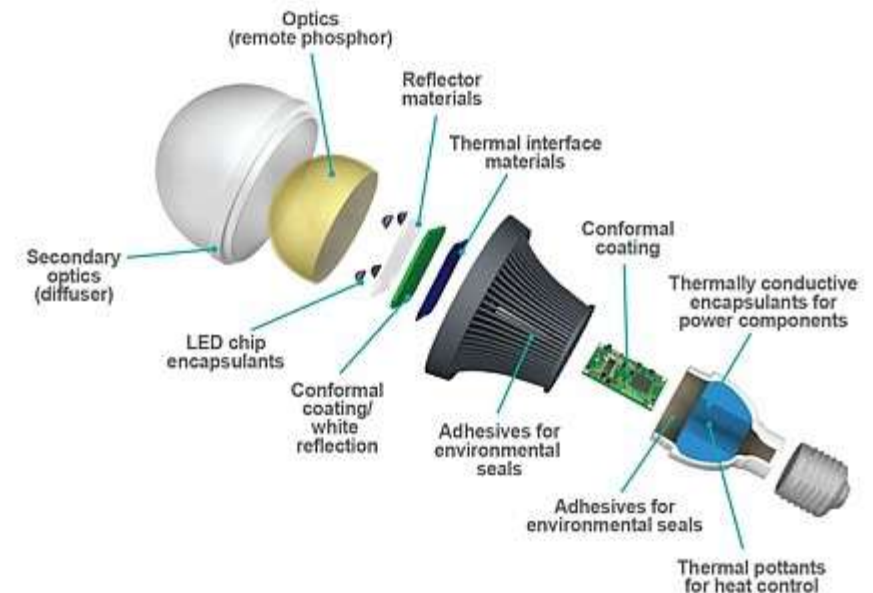


# Complexity



# Complexity

- Incandescent & Halogen sources are:
  - AC mains powered
  - Voltage driven
  - Hot pieces of metal
- LEDs are:
  - DC low voltage powered
  - Current driven
  - Phosphor coated semiconductors
  - ***Complicated***

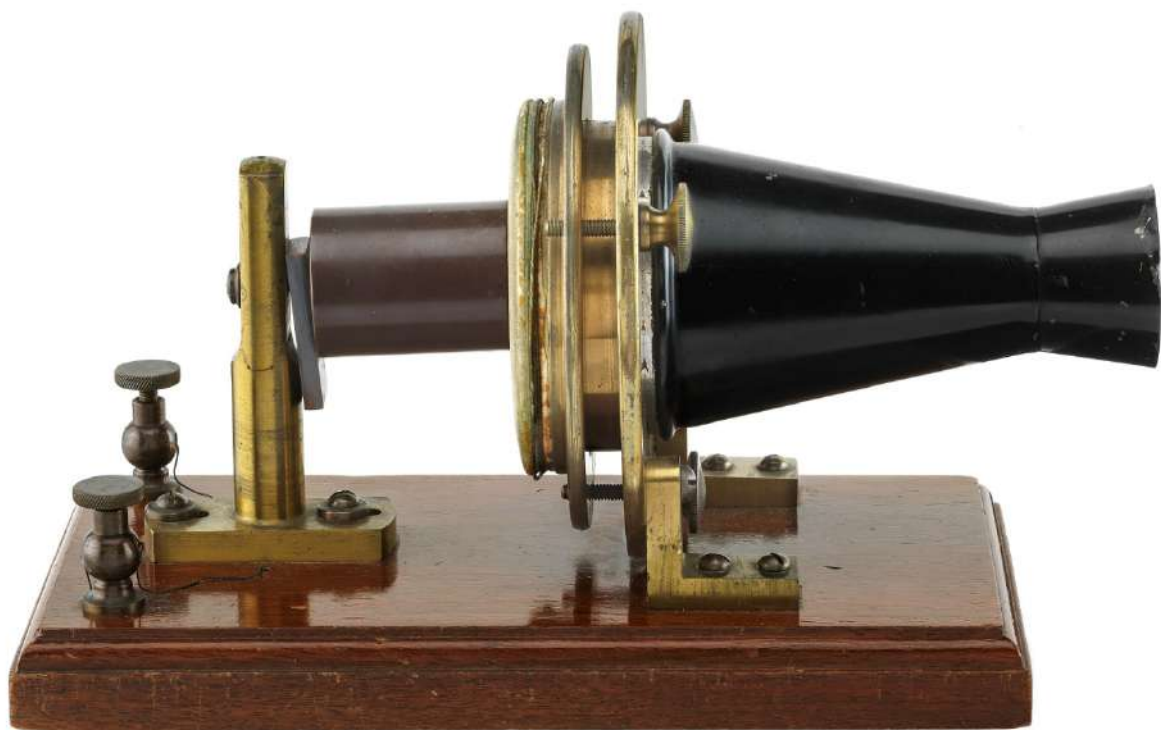


# Complexity

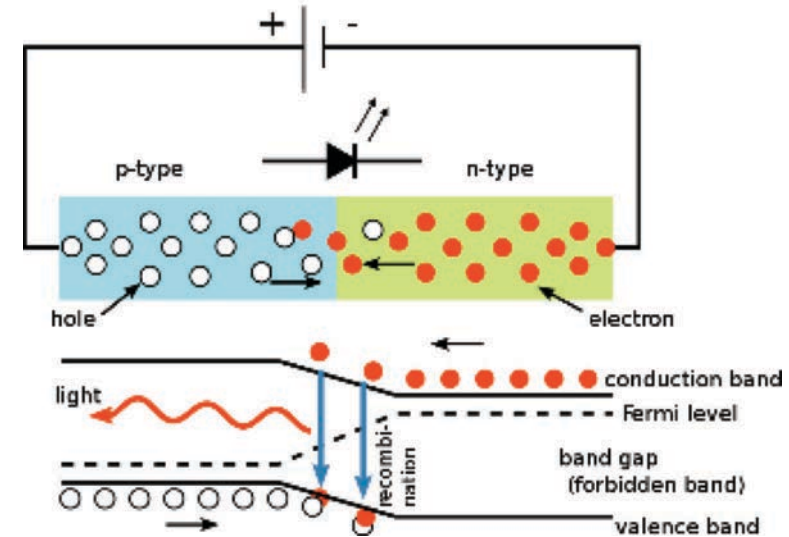
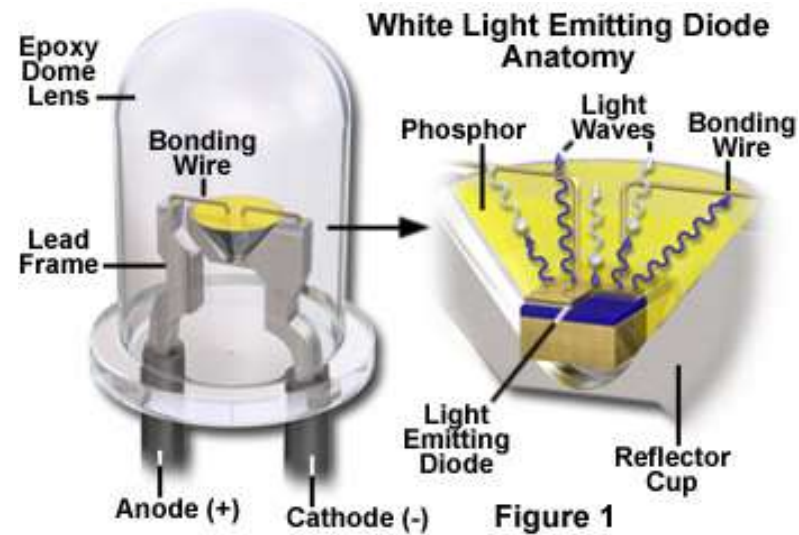
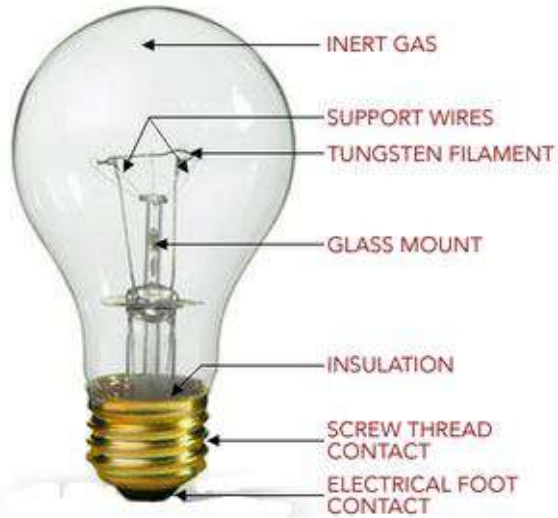




# Complexity



# Complexity

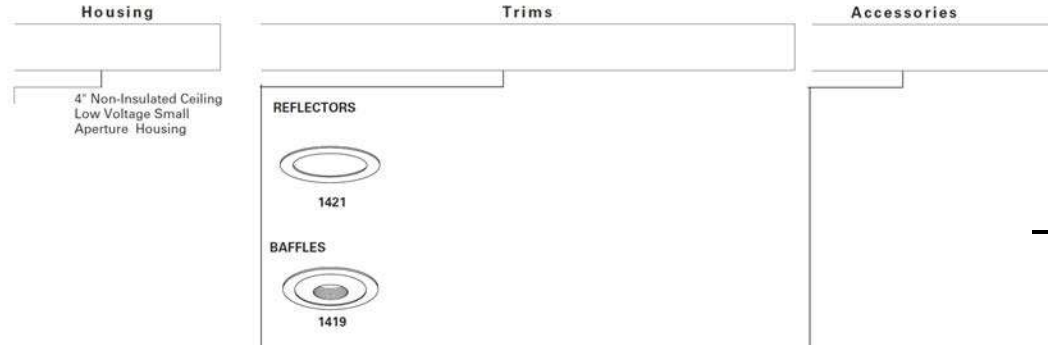


# Tougher Specifications & Installations





# Tougher Specifications



## HOUSING ORDERING INFO

SERIES	LED MODULE WATTAGE AND INFORMATION	CRI / COLOR	BEAM	HOUSING TYPE	DRIVER	VOLTAGE	OPTIONS
Mini Square Trimless New Construction Housing	11L 11W LED / 825lm nom.	8027 80CRI / 2700K	N Narrow 20° M Medium 28° (Use lay-in film for wide distributions)	FD Fixed AD Adjustable*	D1 Phase Dimming (120V only) D2 0-10V Dimming (120-277V only) D3 Forward Phase (120V only) D4 3 wire 1% (120-277V only) DE 1% with Soft-On, Fade-to-Black™ 1% (120-277V only)	1 120V 2 277V U 120-277V*	IC Insulated Ceiling (Not Available in 28C) EM Remotely Mounted Emergency LED Inverter
	16L 16W LED / 1100lm nom.	8030 80CRI / 3000K 8035 80CRI / 3500K 8040 80CRI / 4000K 9027 90CRI / 2700K 9030 90CRI / 3000K 9727 97CRI / 2700K 9730 97CRI / 3000K 9527 95CRI / 2700K 9530 95CRI / 3000K 9535 95CRI / 3500K 9540 95CRI / 4000K					
Small Square Trimless New Construction Housing	09C 09W LED / 900lm nom.	9220 92CRI / 3000-2000K Warm Dimming	N Narrow 16° M Medium 28° (Use lay-in film for wide distributions)	Small housing only	D4 3 wire 1% (120-277V only) DE 1% with Soft-On, Fade-to-Black™ 1% (120-277V only)	* Not Available in 28C	
	14C 14W LED / 1200lm nom. 20C 20W LED / 1600lm nom.* 28C 28W LED / 2200lm nom.* Small housing only	9730 97CRI / 3000K 9527 95CRI / 2700K 9530 95CRI / 3000K 9535 95CRI / 3500K 9540 95CRI / 4000K					
Black finish is standard	15V 15W LED / 810lm nom. 3000-2000K Warm Dimming	9220 92CRI / 3000-2000K Warm Dimming	N Narrow 17° M Medium 25° (Use lay-in film for wide distributions)				

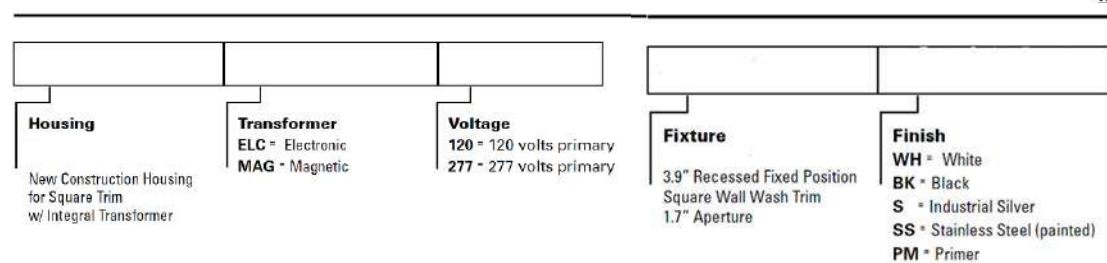
Example: - - - - -

## TRIM ORDERING INFORMATION

TRIM	OPTION	BEVEL STYLE	LENS	FLANGE FINISH	OPTICAL ACCESSORIES
Square Adjustable	W Wet location <sup>1</sup>	B1 1" Regress Bevel, Painted Die Cast Matches Flange Finish AB1 1" Regress Bevel, Black Anodized AC1 1" Regress Bevel, Clear Matte Anodized	S Solite F Frosted C Clear N No Glass	01 Clear Matte (AC Bevel only) 02 Black Anodized (AB Bevel only) 10 White 13 Statuary Bronze 21 Black 28 Metalized Grey RAL Custom Color (specify RAL #)	AL10D Refer to optical accessories matrix on next page for resulting beamspreads when accessory lens is combined with 10° and 25° optics AL15D AL20D AL30D AL40D AL55D AL80D AS61D

Clearly specify quantity in your order

## ORDERING INFORMATION



## HOUSING ORDERING INFORMATION

VG CODE	WATTAGE	ENGINE CODE	COLOR	REFLECTOR	HOUSING TYPE	SELECT ONE VOLTAGE	DIMMING DRIVER OPTIONS	ACCESSORIES
8414	14W LED, 625 lumens	27KS 2700K, 80+ CRI	27KS 2700K, 80+ CRI	10 10° beam 25 25° beam	NC1 New Construction CP Chicago Plenum IC Insulation-Contact Rated / Airtight FTA Flat Adjustable Housing	120V 277V	For use with 120V or 277V DIML2 0-10V dim, 10% (provided standard) DIML4 3-wire/ECO, 1% DIML4E ECO, 5% DIML4H ECO, 1% Fade DIML6A 0-10V, 0.1%, logarithmic DIML6B 0-10V, 0.1%, linear controls DIML6E 0-10V, 1%, logarithmic/ DIML6F 0-10V, 1%, linear controls DIML7 DALI, 0.1%	CB27 27" C-Channel Bars CB52 52" C-Channel Bars EML Emergency battery <sup>3</sup> EMLW Emergency battery, wet location <sup>3</sup>
8420	20W LED, 800 lumens	30KS 3000K, 80+ CRI 35KS 3500K, 80+ CRI 40KS 4000K, 80+ CRI 27KH 2700K, 90+ CRI 30KH 3000K, 90+ CRI	27KS 2700K, 80+ CRI 30KS 3000K, 80+ CRI 35KS 3500K, 80+ CRI 40KS 4000K, 80+ CRI 27KH 2700K, 90+ CRI 30KH 3000K, 90+ CRI			120V	For use with 120V only DIML3 2-wire, 1%, 120V only DIML19 Phase 2-wire dimming, 1% 120V only	
						347V	For use with 347V only DIML15 0-10V dim, 1% 347 only <sup>2</sup>	<sup>3</sup> EM requires above ceiling access. For use with NC1 housing only.

<sup>2</sup> Not available with FTA housing

# Tougher Specifications

We reserve the right to change or withdraw specifications without prior notice.

We are constantly improving our fixtures and reserve the right to change options and specifications.

reserves the right to change details that do not affect overall function and performance.

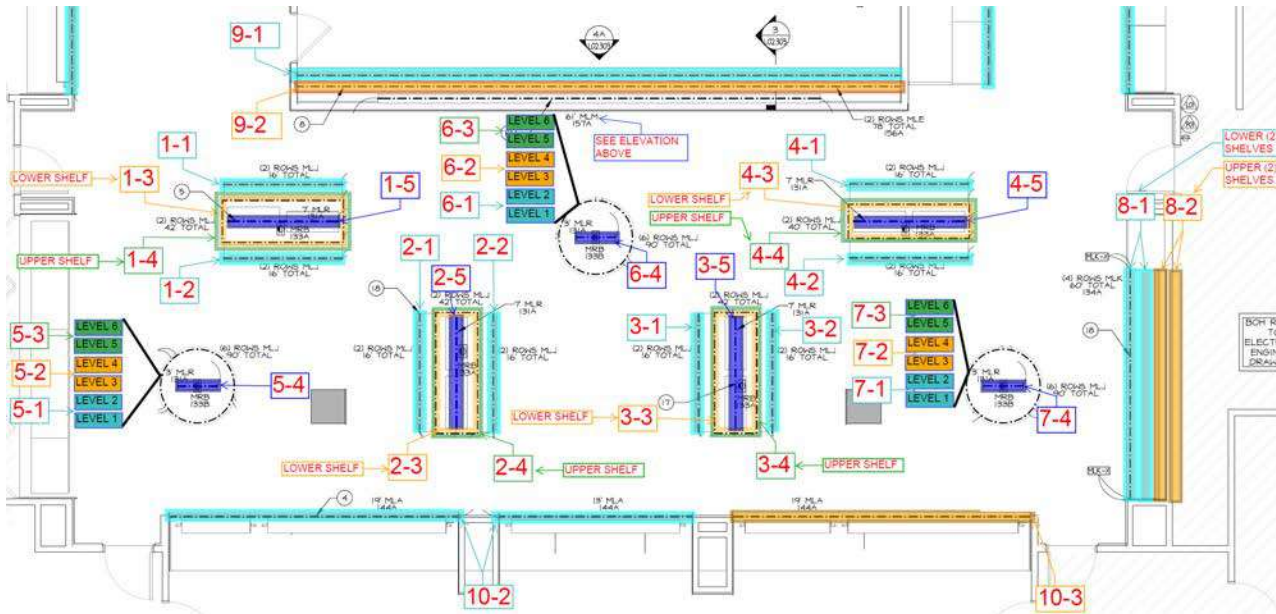


# Complexity & Tougher Specs – Ideas and Solutions

- Attitude
- Consider the whole system
- Spec what you know / have tested or seen
- Consider project time line
- Need More...
  - Knowledge & education
  - Designer involvement
  - Manufacturer support (samples, testing)
  - Documentation

# Tougher Installations

- Remote power supplies.
  - More to install.
  - More access panels.
  - More coordination.



## - TRANSFORMER AND POWER SUPPLY SCHEDULE

### MARKET DISPLAYS

133A	GRAB AND GO: DISPLAY SHELF LIGHTING				SHEET:	L02.101.J
XFMR #	LOAD	QTY	WATTS	Wattage	TYPE:	MU
1-1	A	8 FT	2.7w	21.2w	TOTAL W:	42.4w
	B	8 FT	2.7w	21.2w	XFMR:	
					VOLT:	24VDC
					DIMS:	3.25"x3.37"x11.25"

133A	GRAB AND GO: DISPLAY SHELF LIGHTING				SHEET:	L02.101.J
XFMR #	LOAD	QTY	WATTS	Wattage	TYPE:	MU
1-2	A	8 FT	2.7w	21.2w	TOTAL W:	42.4w
	B	8 FT	2.7w	21.2w	XFMR:	
					VOLT:	24VDC
					DIMS:	3.25"x3.37"x11.25"

133A	GRAB AND GO: DISPLAY SHELF LIGHTING				SHEET:	L02.101.J
XFMR #	LOAD	QTY	WATTS	Wattage	TYPE:	MU
1-3	A	22 FT	2.7w	58.3w	TOTAL W:	58.3w
					XFMR:	
					VOLT:	24VDC
					DIMS:	3.25"x3.37"x11.25"

133A	GRAB AND GO: DISPLAY SHELF LIGHTING				SHEET:	L02.101.J
XFMR #	LOAD	QTY	WATTS	Wattage	TYPE:	MU
1-4	A	22 FT	2.7w	58.3w	TOTAL W:	58.3w
					XFMR:	
					VOLT:	24VDC
					DIMS:	3.25"x3.37"x11.25"

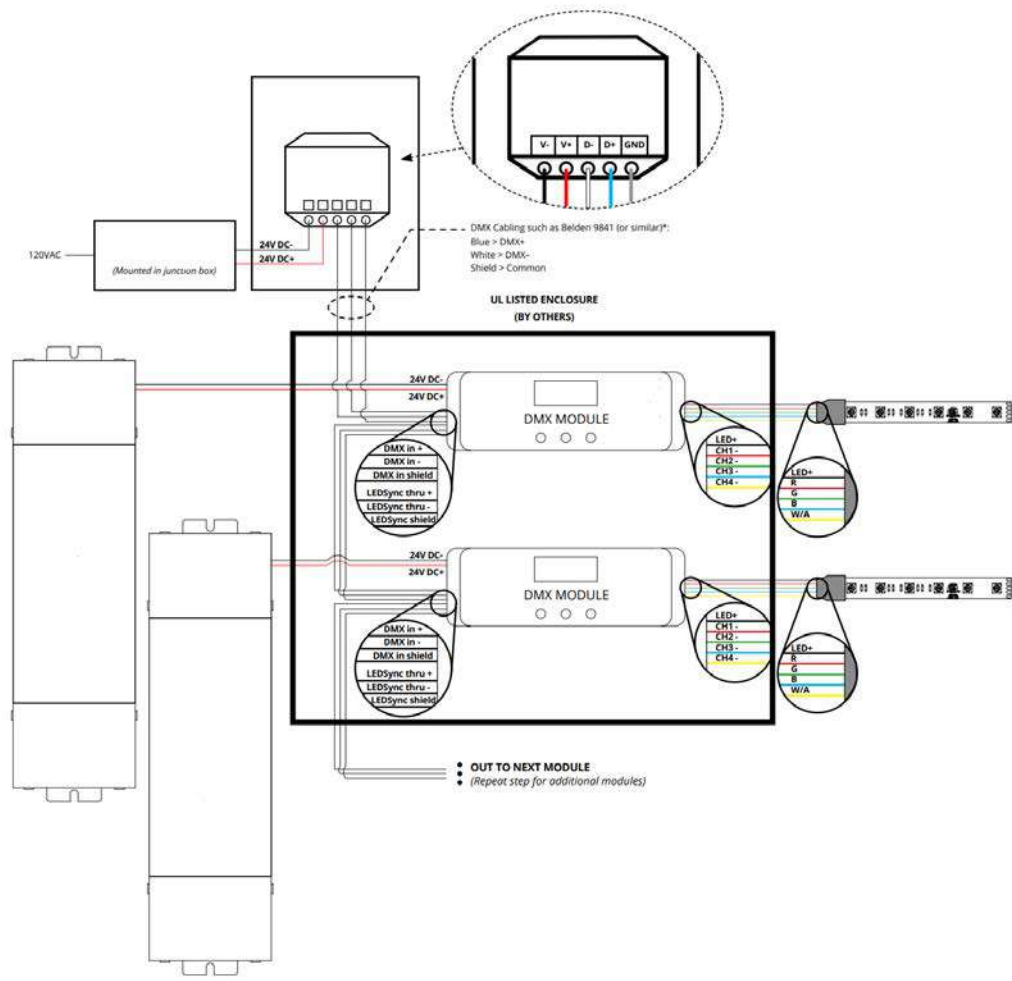
131A	GRAB AND GO: SIGNAGE DISPLAY UPLIGHT				SHEET:	L02.101.J
XFMR #	LOAD	QTY	WATTS	Wattage	TYPE:	MLR
1-5	A	8 FT	2.5w	20.w	TOTAL W:	20.w
					XFMR:	
					VOLT:	24VDC
					DIMS:	3.25"x3.37"x11.25"

133A	GRAB AND GO: DISPLAY SHELF LIGHTING				SHEET:	L02.101.J
XFMR #	LOAD	QTY	WATTS	Wattage	TYPE:	MU
2-1	A	8 FT	2.7w	21.2w	TOTAL W:	42.4w
	B	8 FT	2.7w	21.2w	XFMR:	
					VOLT:	24VDC
					DIMS:	3.25"x3.37"x11.25"

133A	GRAB AND GO: DISPLAY SHELF LIGHTING				SHEET:	L02.101.J
XFMR #	LOAD	QTY	WATTS	Wattage	TYPE:	MU
2-2	A	8 FT	2.7w	21.2w	TOTAL W:	42.4w
	B	8 FT	2.7w	21.2w	XFMR:	
					VOLT:	24VDC
					DIMS:	3.25"x3.37"x11.25"

# Tougher Installations

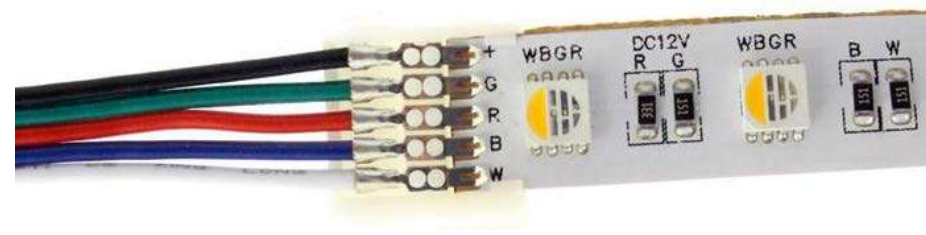
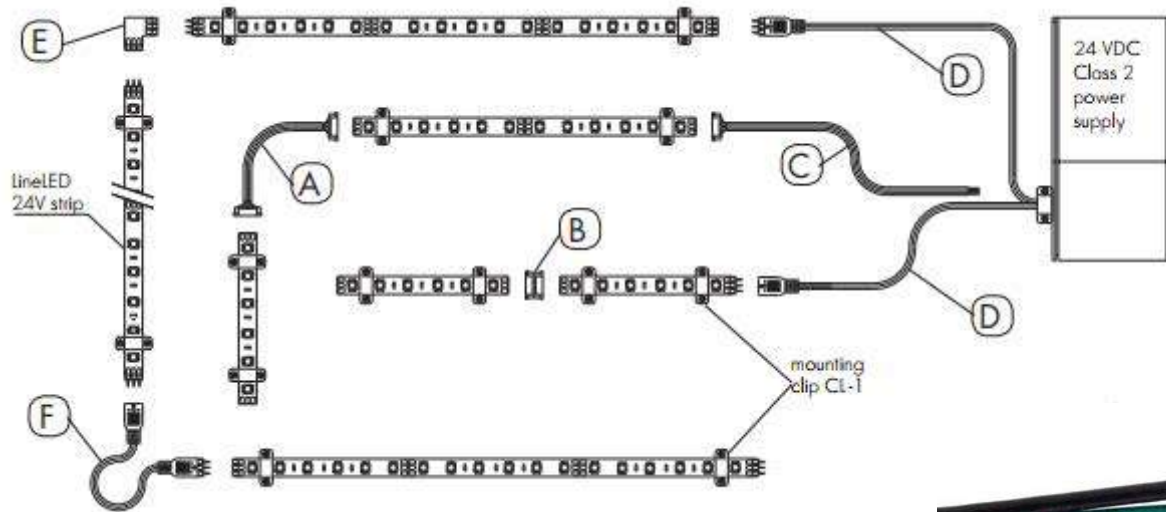
- Low voltage control (0-10v, DMX, DALI, etc.)



ALL DMX CABLING SHALL CONFORM TO ANSI E1.27-2-2009 (R2014), RECOMMENDED PRACTICE FOR PERMANENTLY INSTALLED CONTROL CABLES FOR USE WITH ANSI E1.11 (DMX512-A) AND USITT DMX512/1990 PRODUCTS.

# Tougher Installations

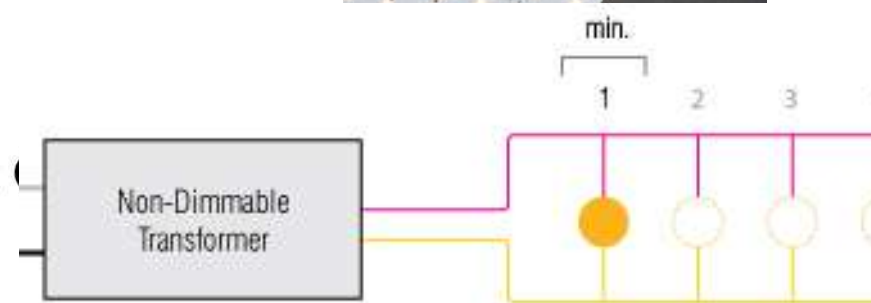
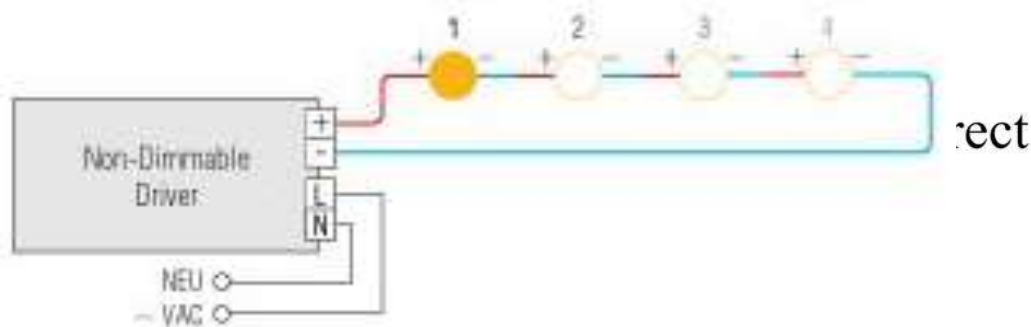
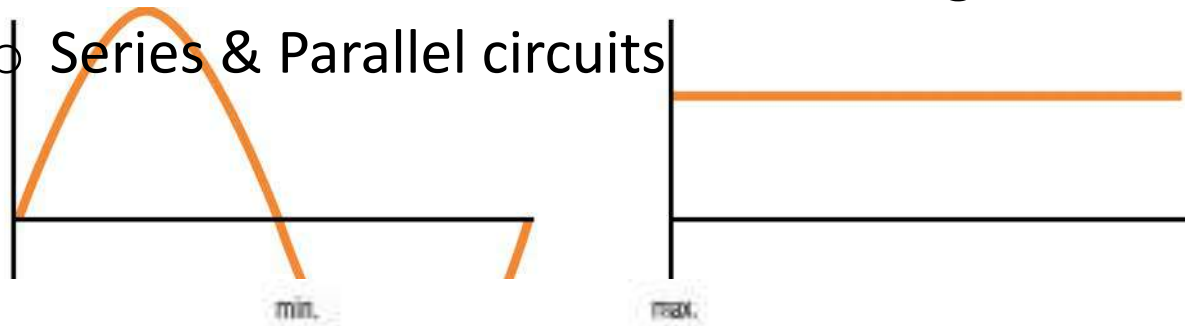
- More fragile
- More parts & pieces





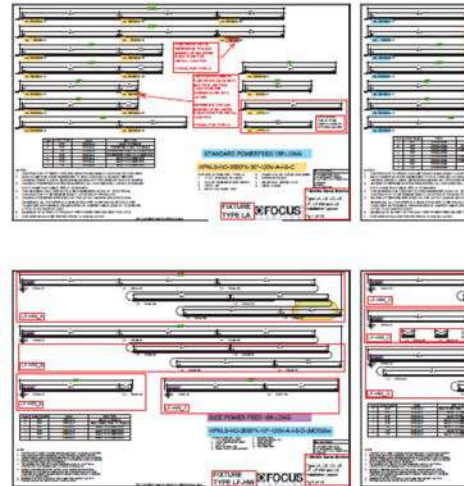
# Tougher Installations

- Greater electrical variety
  - AC & DC
  - 12v, 24v, 48v, 120v, etc.
  - Constant Current & Constant Voltage.
  - Series & Parallel circuits



# Tougher Installations – Ideas & Solutions

- Manufacturer & Reps:
  - More Tech support
  - Local person in large markets?
  - More info on cutsheets
- Specifiers:
  - Minimize variations.
  - Samples & mockups for installers
- Installers:
  - Calculate voltage drop early.
  - Test low voltage data before the ceilings/walls are closed.
  - Read the damn installation instructions.



TECHNICAL DATA	
Parameter	Data
WATTAGE:	6 watts per linear ft.
INPUT VOLTAGE:	90-120V or 230-277V
INPUT CURRENT PER LINEAR FT:	54mA@120V or 24mA@277V
CONTROL:	Leading-edge/Trailing-edge line dimmer
POWER CABLE LENGTH:	UL Standard 6ft
LED SPACING:	5/8" on center
FIXTURE LENGTH:	12"-72" in 4" increment
FIXTURE WIDTH:	1.04"
TOTAL HEIGHT (NOT INCLUDING CLIP):	0.82"
MOUNTING:	Adjustable Swivel Clip
AVAILABLE OPTICS:	120°
FINISH OPTIONS:	White or Black high temperature ABS plastic
LED COLOR OPTIONS:	2K, 24K, 27K, 3K, 35K, 4K, 5K, 65K
COLOR RENDERING INDEX (CRI):	90+ CRI
RATINGS:	Dry
TOTAL LINEAR FT PER 20A BREAKER:	210ft@120V or 470ft@277V
TOTAL LINEAR FT PER 15A BREAKER:	156ft@120V or 350ft@277V
TOTAL LINEAR FT PER POWER FEED:	76ft@120V or 156ft@277V
TRANSFORMER:	N/A

# Tougher Installations – Ideas & Solutions

- Everyone
  - More Coordination.
  - More Communication.

# Failures & Replacements





# Failures & Replacements

- It's not 50K hours.
  - False sense of security.
- Getting Replacements.
  - Match?
  - Discontinued?
  - Warranty & Support
  - Will you need an electrician?

# Replacements & Color Consistency

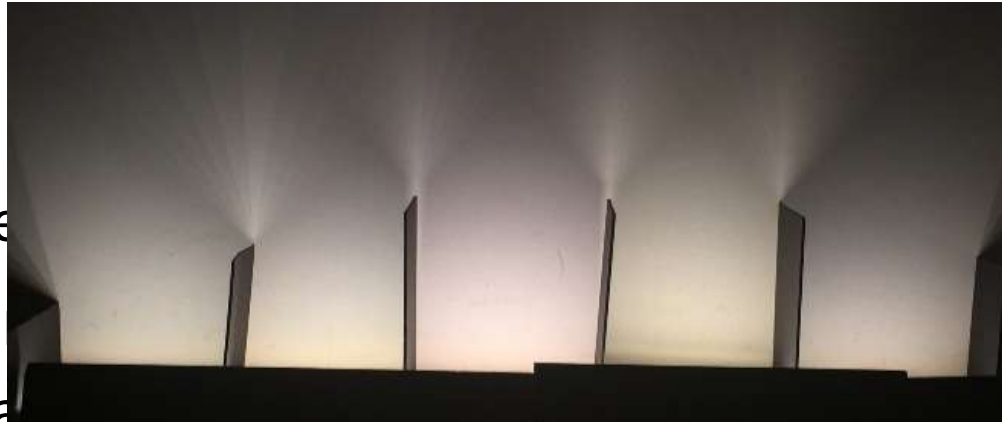
- Color temp is a range by definition & manufacturing standards.

- Specifiers:

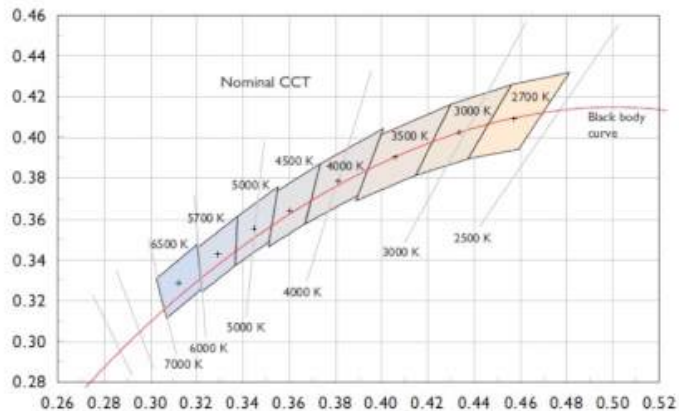
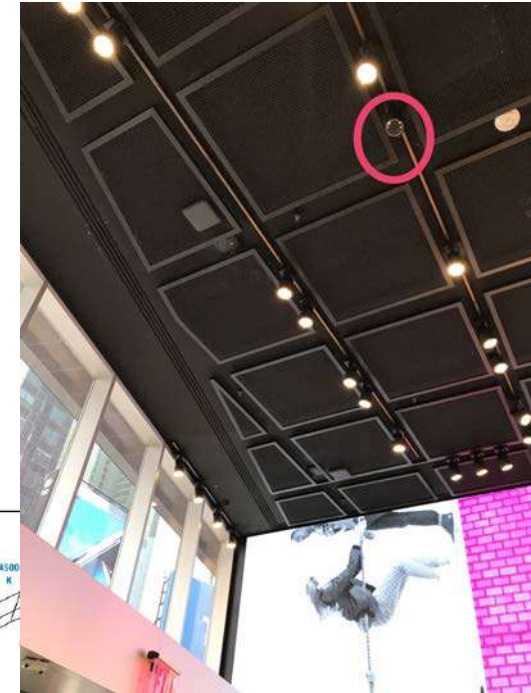
- Color warranty
- Matching replacement

- Matching replacement

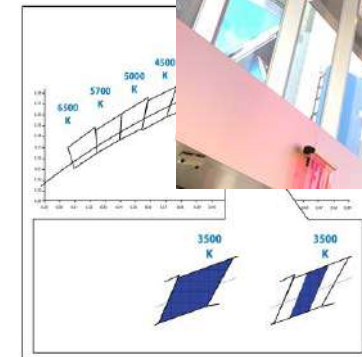
- Construction: Have spares
- Maintenance: 'Have Attic Stock - Don't lose it!



so:



Nominal CCT	Target CCT (K) and Tolerance
2700 K	2725 ± 145
3000 K	3045 ± 175
3500 K	3465 ± 245
4000 K	3985 ± 275

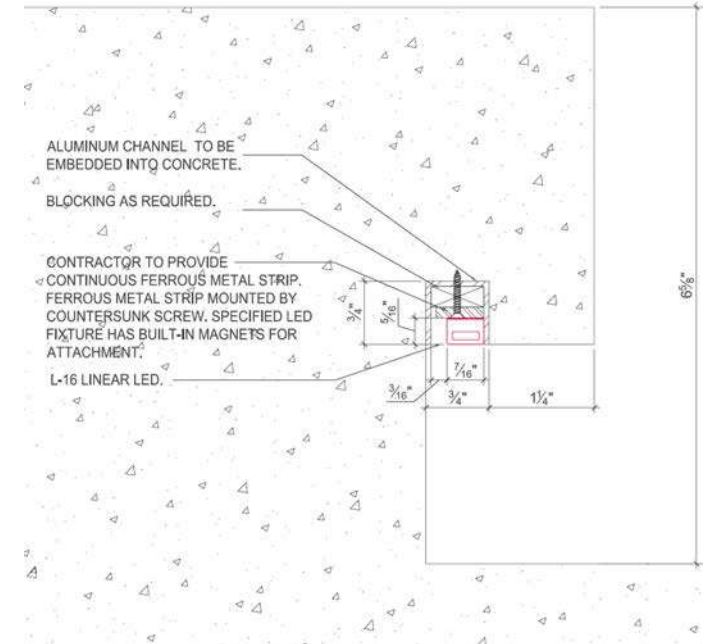


# Replacements – Other considerations

- Output (brightness) has to match.
  - Discontinued (w/o direct replacement)
  - Discontinued (w/ a replacement...but it is different)
  - Different components
  - Out of business
- 
- If I replace one, do I have to replace them all?

# Failures & Replacements – Ideas & Solutions

- Specifiers:
  - Design accessible details or explain the risk.
  - Choose manufacturers that are consistent and will support.
  - Choose robust fixtures.
- Specifiers/Installers:
  - Burn in.
  - Heat. Ventilation. Thermal management.
  - Spares & Attic Stock.
  - Don't allow/get crap.
  - Define “catastrophic.”
- Manufacturers:
  - Keep parts & replacements.
  - Transparency.

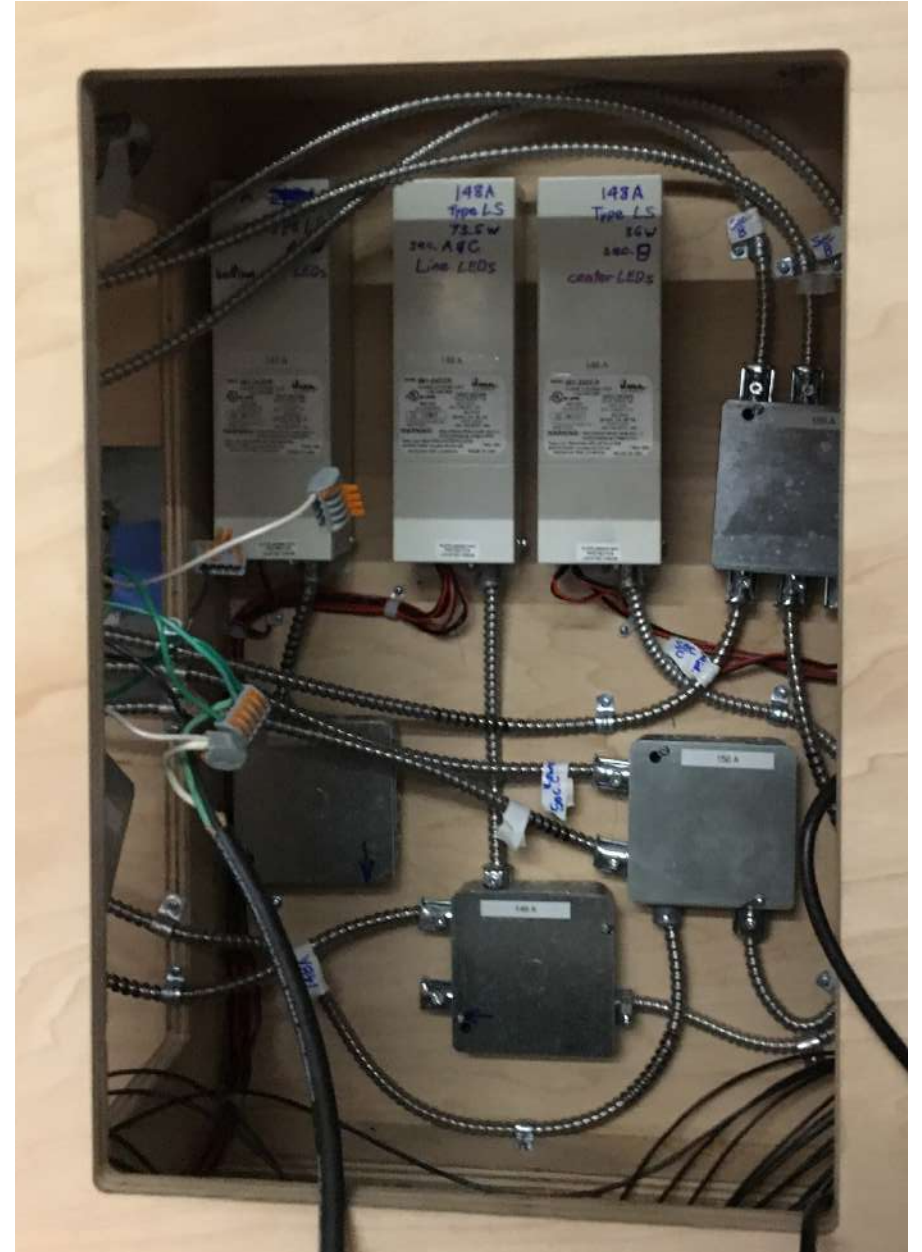


# Maintenance



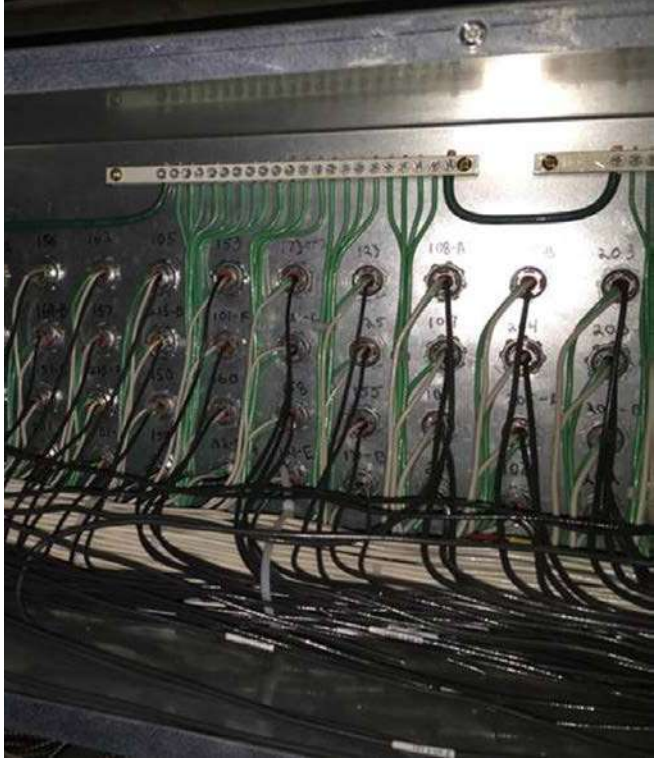
# Maintenance

- Owners / Maintenance staffs:
  - Budget yearly maintenance.
  - Training
- Installer:
  - Adequate space, access, marking for drivers.
  - Provide project documentation & training.
- Specifiers:
  - Specify what's required
  - Confirm it was done.





# A digression...



A digression...





A digression...



# Maintenance



Fri, 12/1/2017 12:23 PM

Park Central Hotel Lounge

To: Kenneth Schutz

Cc:

You forwarded this message on 12/1/2017 1:42 PM.

Message IMG\_0590.jpg (58 KB)

Good day Kenny,

Please find enclosed a photo of the pendants here at the Park Central Hotel Lounge.

The issue we are having is flickering of the pendants when they dim for the evening scene.

The issue started when we did a group re-lamping after several tries with different LED lamps we continue to have the same issue.

The lamp we had with no issue was a [REDACTED] unfortunately it's no longer available.

We recently installed [REDACTED]

The [REDACTED] seems to be working in two of the four pendants but two keep flickering.

Any advice you can provide is much appreciated.

Regards,

Director of Engineering





# Maintenance

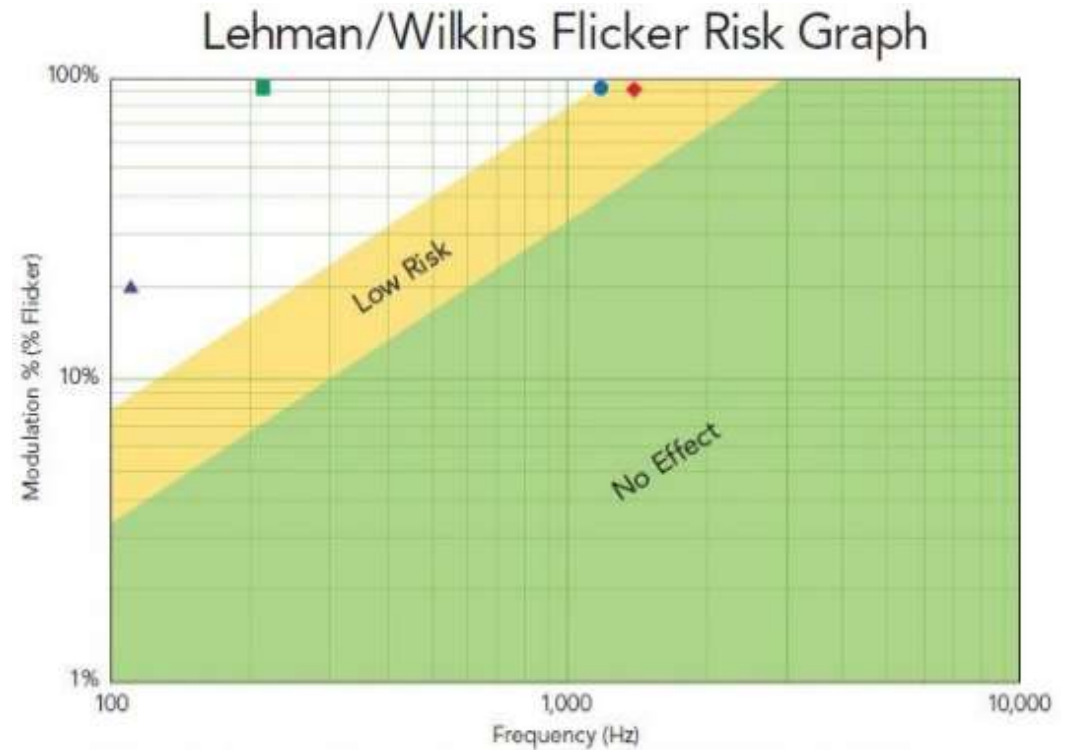


# Flicker



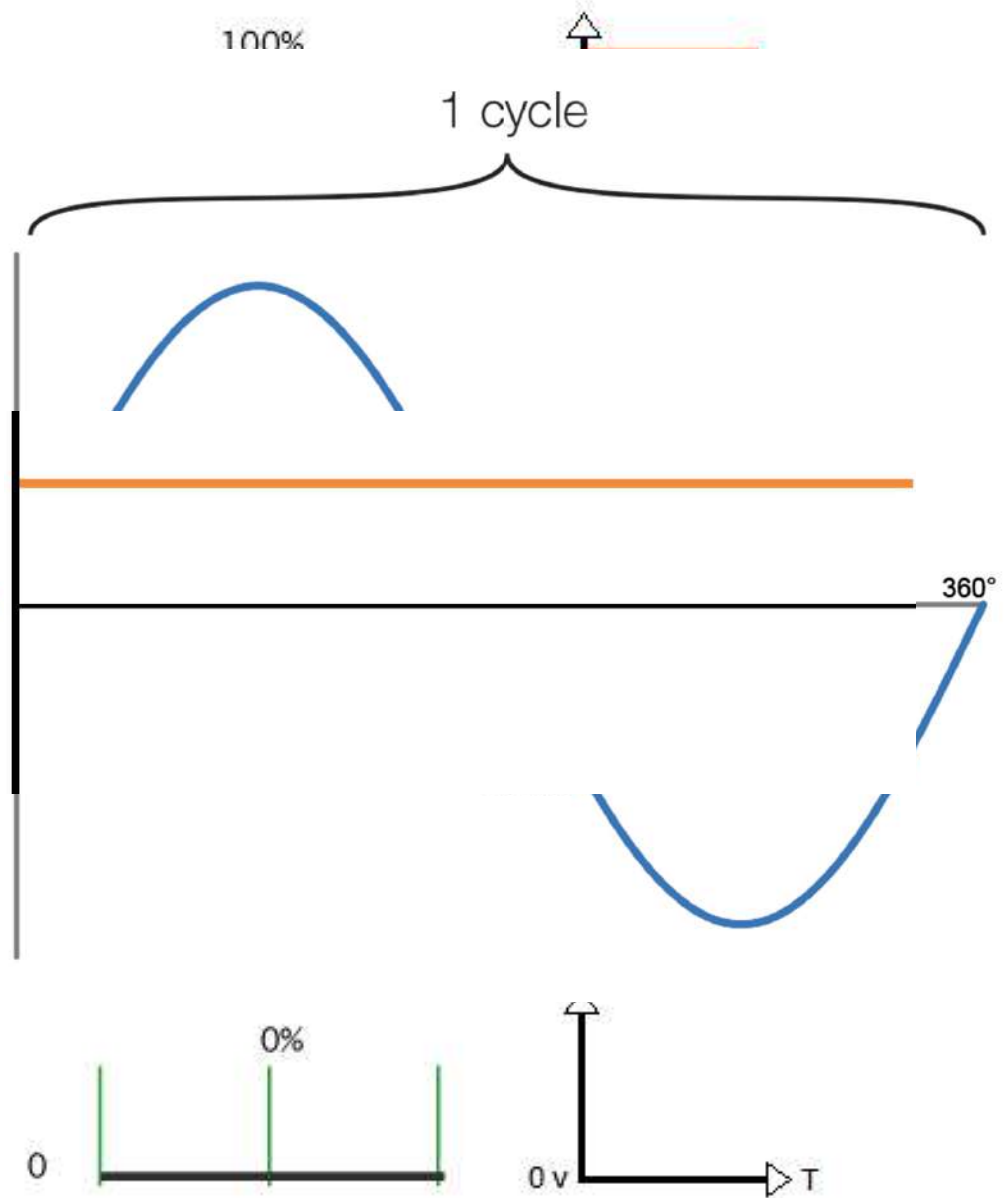
# Flicker

- It's the Driver, stupid.



# Flicker

- It's the Driver, stupid.
- AC is flicker.
- Digital dimming.
- Dimming DC.
- 0-10, DMX, DALI, etc.
- 2-wire dimming...



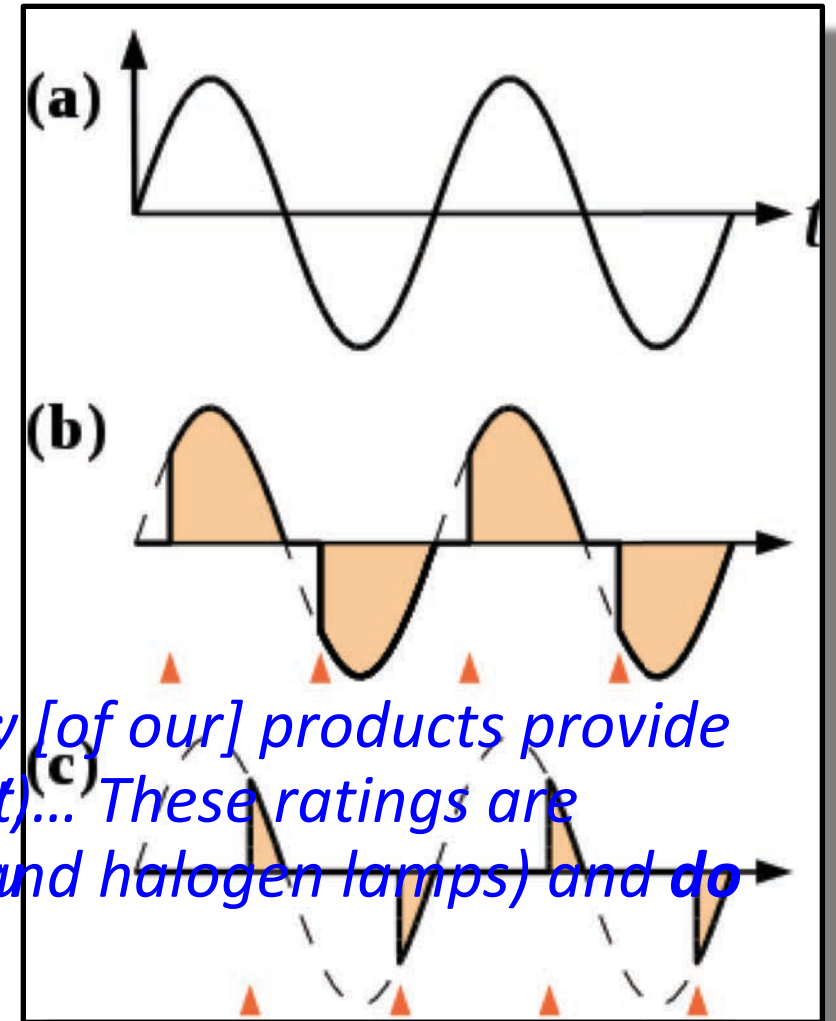
# 2-wire dimming



# 2-wire dimming

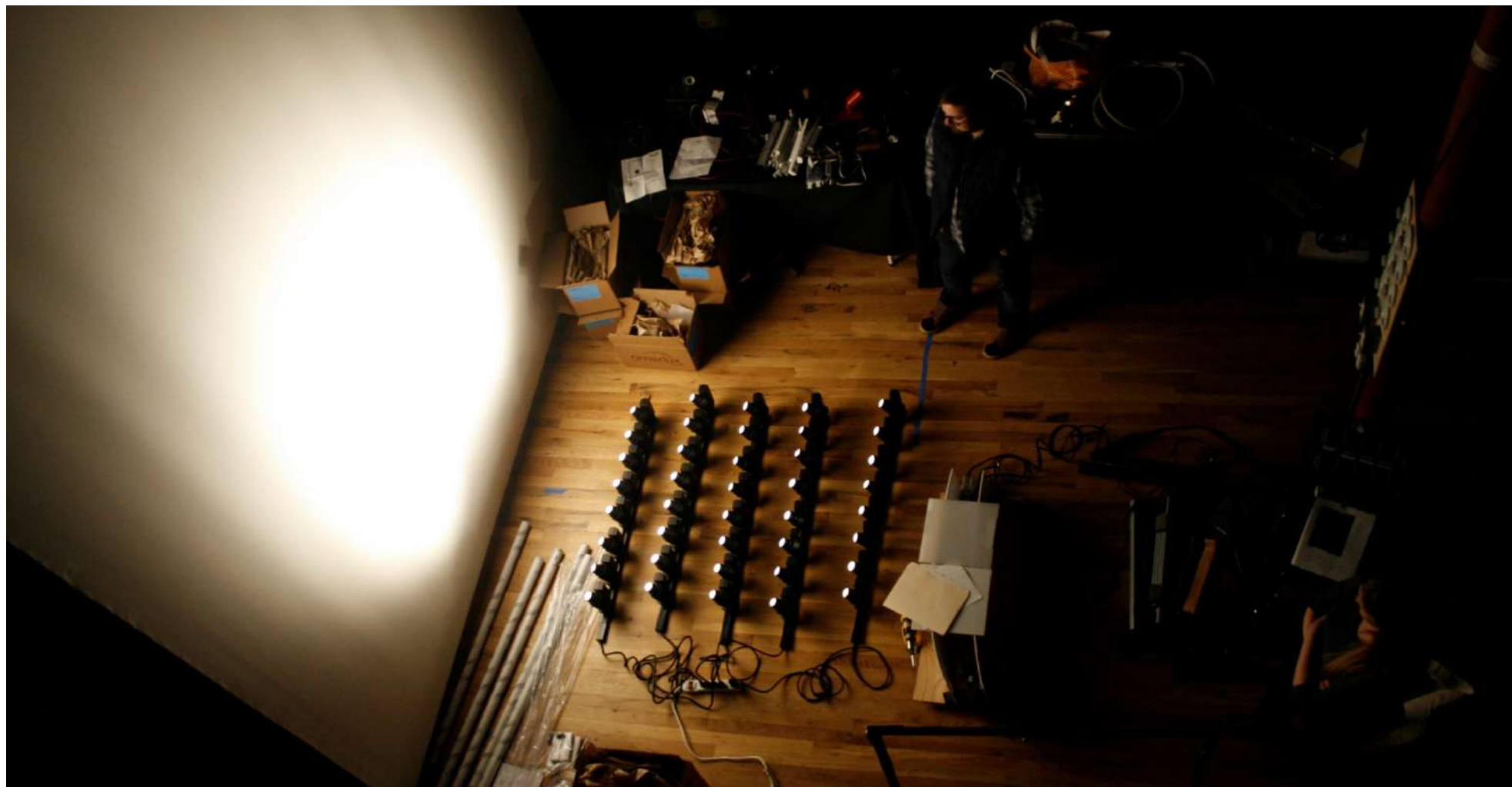
- More flicker
- *System* compatibility.
- Quantity matters.
  - Not just dim min. load.
  - In rush / Rep peak
  - Capacitance

• [Eaton's dimming guide for LED's](#) [Delta's App Note](#) [Merry \[of our\] products provide ratings for dimming because of things in Watts \(W\)... These ratings are based on it for 50VAC \(incandescent and halogen lamps\) and do not apply to LED and CFL lamps.](#)





# 2-wire dimming



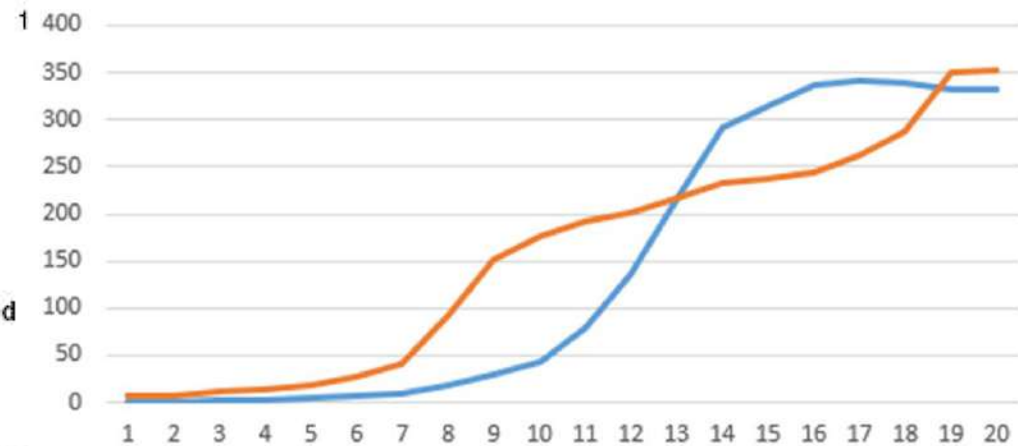
# Back to drivers

- Component changes
- Behavior & Compatibility.
- The “1% Driver.”

Measured Light



FIGURE 6:



$$\text{Dimmed Light (\%)} = \frac{\text{Measured Light (\%)}}{100}$$

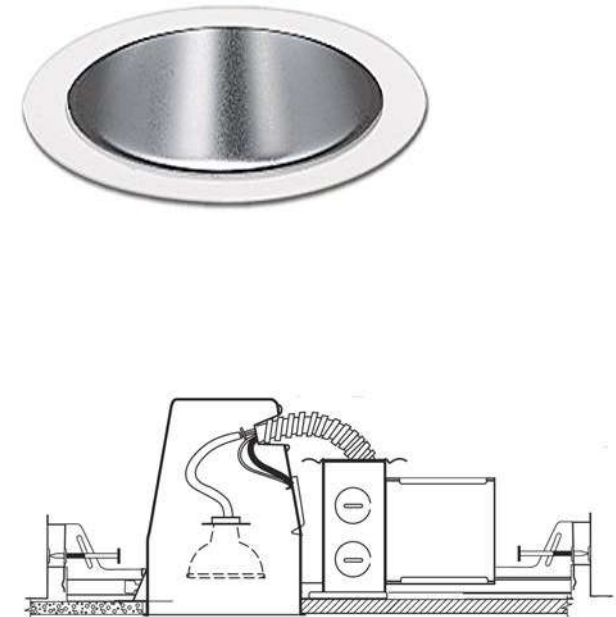
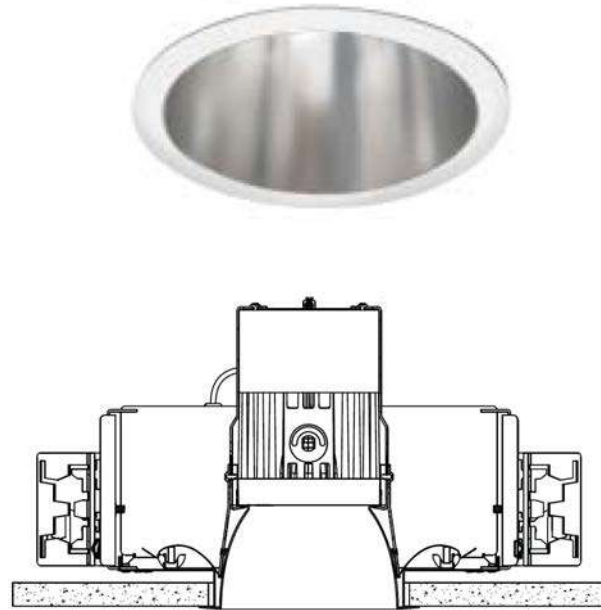


# Value Engineering



# Value Engineering

- Hotel Ballroom w/ 20' (+/-) ceiling
- 6" downlight
- Semi-diffuse specular reflector
- 40 degree optic
- 38w, 2400lm



# Value Engineering

<b>SPECIFICATION</b>	<b>AS SPECIFIED</b>
IP	IP66
MAX RUN	100'
COLOR	RGBW
LUMENS	419 lm / FT
WHITE	6000K
WEIGHT	1.25 LBS / FT
WATTAGE	9w / FT
HEIGHT x WIDTH	2.32" x 2.17"
REMOTE BOX?	NO

Don't be this guy...





Thank you!





This concludes The American Institute of Architects Continuing  
Education Systems Course



Thank you again!

