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During the Class Attendees will be muted Please use the chat feature in the control panel to submit questions to LDL staff The presenter will pause to address questions every ~10 minutes Please participate in the online polls.

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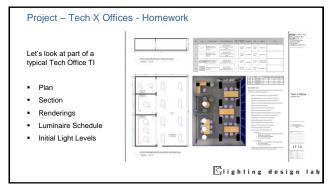


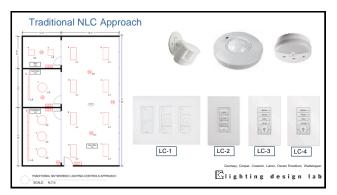


Learning Objectives

- Understand and be able to apply common control strategies
- Understand and be able to apply typical controls hardware
- Understand how networked control devices may be wired
- Understand how to do essential system startup for networked systems.
 - Pairing devices
 - Setting high trim
 - Setting timeouts
 - Setting daylight zones
- Gaining comfort with hardware and software

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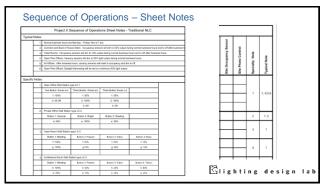
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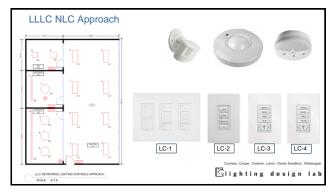
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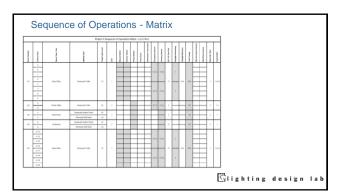
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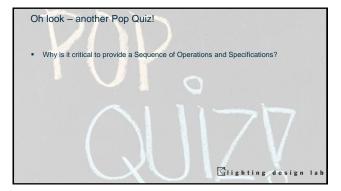
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Project X Tech Offices - Implementation For startup we'll assume that the program looks like this: • z1: Open Office Primary Daylight Zone • z2: Open Office Secondary Daylight Zone • z3: Conference Room Pendants • z4: Conference Room Wall Wash • z7: Private Office 2x2 • Vacancy Sensors • Lighting Control Stations • Daylight Sensor

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Common Energy Code Control Highlights Energy Codes handle lighting controls in different specific ways, but there are many commonalities. Washington State, Seattle, Idaho, and Montana energy codes are based on the IECC. Energy code should be baseline -Clighting design lab

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Extinguish Lighting When Not Needed

Occupancy / Vacancy Sensing - Required in most project areas.

- Open Plan Offices
- Private Offices
- Conference Rooms
- Classrooms
- Stairwells
- Toilet rooms
- Storage
- Lounges
- Public spaces
- Janitorial Copy / Print
- Break Rooms
- Warehouses
- Parking garages
- Site lighting
- Spaces 300 sf or less enclosed by ceiling height partitions.
- May be programmed to dim rather than extinguish



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Schedule Lighting Only When Needed

Time of day events generally used for large areas or public spaces.

Multiple calendars are generally required.

- Open Plan Offices
- Public spaces
- Corridors
- Site lighting Retail
- Hospitality
- Spaces that need to be controlled together or may be difficult to control by
- May include required dimming events.



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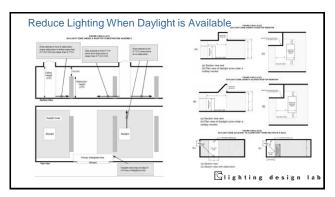
Stairwells and Corridors And Garages Oh My!

- Each stairway shall have one or more control devices to automatically reduce lighting power by not less than 50 percent when no occupants have been detected in the stairway for a period not exceeding 15 minutes, and restore lighting to full power when occupants enter the stairway. (there is more)
- Lighting in parking garages shall have one or more control devices to automatically reduce lighting power in any one controlled zone by not less than 50 percent when no occupants have been detected in that zone for a period not exceeding 30 minutes, and restore lighting to full power when occupants enter or approach the zone.

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Reduce Lighting When Daylight is Available Daylight harvesting. Dim or extinguish electric lighting when daylight is available Some codes require single daylight zones, others require primary and secondary zones. Determining those actual zones can take some work.



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Emergency – 24 hour lighting Emergency lighting was frequently provided by a 24 hour constant hot circuit in the past. That is no longer allowed in most cases. | That is no longer allowed in most cases.

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Emergency Lighting Using UL924 Load Controllers Glighting design lab

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Exterior Lighting

- Where lighting the building facade or landscape, the lighting shall have controls that automatically shut off the lighting between midnight or business/facility closing, whichever is later, and 6 a.m. or business/facility opening, whichever is earlier.
- business/facility opening, whichever is earlier.
- Exterior occupancy control
- Exterior dimming
- Migratory patterns, etc



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Controlled Receptacles

- 50% of all outlets to be controlled
- Scheduling
- Occupancy Sensing
- Vampire plug loads
- Don't plug in CPUs....



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Commissioning

- Third Party Commissioning may be required
- Commissioning Plan
- Certified Commissioning Professional
- Functional Testing
- Final Report
- Startup and Commissioning are not the same thing



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LLLC - Easy Compliance

- Using LLLC luminaires basically guarantees energy code compliance.
- Some jurisdictions allow LLLC use to eliminate the need for further controls documentation.
- www.lightingdesignlab.com/resources
 - Videos
 - Learning Guides



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Commissioning

 One of the most often overlooked Commissioning elements....

Commission the occupants....

 Let them know what to expect from the system and how it operates....and why....



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Quick Case Study

- Occupant is an MEP engineering firm in the third floor of the Bullitt Center in Seattle.
- Approximately 6,100 square feet
- TI renovation
- Completed in 2017



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Lighting Design

- High performance LED lighting
- LED decorative
- 3400 watts connected load
- LPD: ~ 0.55 W/sf
- Controls
 - Dimming
 - Task tuning
 - Vacancy sensing
- Daylight harvesting
- Manual dimming



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Value Engineering

- Controls design VE
- Met Energy Code...
- Cheapest way possible..
- Barely functional...
- Not possible to fully extinguish electric lights...



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Lighting Control Retrofit

- Distributed load controls
- Luminaire level addressing
- Wireless switches/dimmers
- Wireless sensors
- Daylight harvesting
- Task tuning
- Manual dimming
- Time of day schedule
- More or less LLLC



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Results

- · Staff can turn all of the lights off
- · Staff can select appropriate dimmed levels





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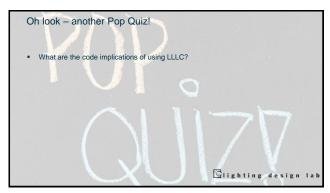
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Results

- Task-tuned by more than 25%
- Daylight dimming fully functional
- Vacancy sensing by contiguous row
- Effective LPD is ~ 0.15 W/sf
- More than 70% effective reduction
- Controls cost: ~ \$4,500
- ~ \$0.78 / sf



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Control Systems We work with many different control systems manufacturers for this class. • Acuity nLight Air • Audacy by Ideal • Cooper Wavelinx • Cree Smartcast • Cree Smartcast • Crestron Zum • Encellium Edge • ETC Echoflex • Lutron Vive

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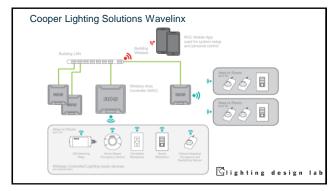




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There are certainly differences between the systems. Specifying and installing the hardware is really not that different. Programming? Well...also not really all that different – at least for the basic concepts.

Lets Start with basic communications Most networked or seminetworked systems will feature a communications and programming hub. Devices communicate via radio frequency - zigbee...or blue tooth...or some proprietary protocol...or...or... Courtagy Latino. Corpus: Excellunt. Andatoy





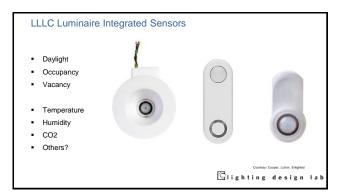


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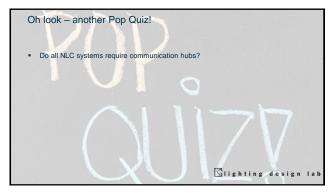




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Demonstration Boards

- When we get back to being able to meet in person
- Control boards are meant to emulate building or fixture wiring in miniature.
- Each fixture represents one of the luminaires in the example – per the photos on each.
- Each luminaire represents one control zone



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System Startup / Programming

- Ok we've seen the parts and pieces and how to do the basic wiring.
- We've seen how the major components are installed.
- What about the system programming?



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Apps

- Many systems today are configurable by smart device app – not just for lighting.
- These apps may all be downloaded to your phones or tablets from apple or google to work with your respective devices.















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Communications

- Programming...where to begin?
- The first step is to power up the communications hub, router, etc.
- To save time, the hubs are already powered and have a base configuration.



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Next Steps

- The following steps will be general practice.
- The order of information entry and coordination may vary significantly but the actual information required and entered will be very similar.



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Device Discovery

- Some systems will query the local area in search of devices that may be new to the area or system.
- Some systems will require you to physically touch the devices you with to add to the system or engage in some other specific step such as scanning a QR code.
- The specific steps and order will vary so let's look at general concepts.



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Project Information Project Name Project Location Project Latitude and Longitude Designer? ■ Engineer? Any others?

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Areas / Rooms

- Define each logical physical area on the project.
- Normally this will mean rooms enclosed by full height partitions, but not always.
- Sometimes it helps to define subareas within areas to control them separately with simple systems.

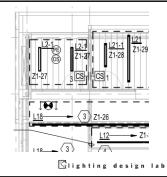


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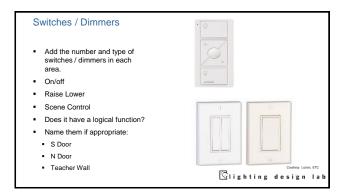
Control Zones

- Add control zones / load controllers for each area.
- Take the time to name them according to project plan nomenclature.
- If space, add the function as well.
- Z1-27 Office Linear L2-1



Plug Load Zones / Controllers Add plug load controllers or outlets. Take the time to name them according to project plan nomenclature.

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Daylight Harvesting

- Add the daylight sensors in each area
- Designate primary and secondary daylight zones if appropriate.
- Open loop or closed loop? Both?
- Set dimming level if appropriate
- Any other functions that may be set?
- This may be the trickiest bit of setup.
- Name them if appropriate:
- Corridor S
- Corridor N



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Pairing

- Define which control zones are paired to:
- Switches
- Dimmers
- Switch Buttons
- Groups
- Scenes / Presets
- Vacancy Sensors
- Daylight areas
- Plug loads



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Setting Levels

- Set lighting levels within the area.
- Individual switch/zone
- Scene / Preset
- Visual balance
- Energy Savings





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Task Tuning

- Set a high trim for the control system aligned with the target light level for the area.
- This can frequently result in as much as 30% initial energy savings in a well designed space.



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Scheduling

- Add any time of day events for each area.
- Time On
- Time Off
- Weekday
- Weekend
- Astronomic
- Logical Events

SUN	MON	TUE	MED	THU	FRI	SAT
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

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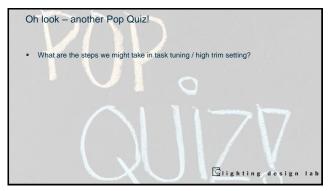
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Demand Response - Load Shed

- Define the control zones to be dimmed
- Define the dimming level
- Configure to accept the signal from the utility.
- Dimming wide areas by a small amount can meet the reduction target while retaining functionality.



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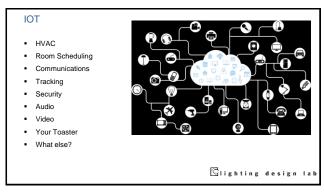


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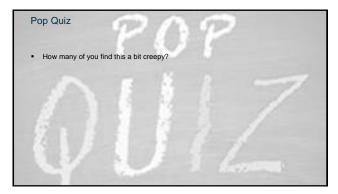
Future of Lighting Controls	
Where do we go from here? What do YOU think?	
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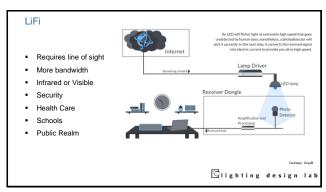






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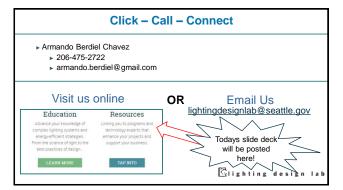




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Upcoming LDL O	nline Events	
LDL Course	Delivery Date	Time
The Lighting Design Process	July 28	10:00 - Noon
Audit and Retrofit Techniques	August 11	10:00 - Noon
Introduction to Codes and Standards	August 25	10:00 - Noon
Promoting Energy Efficient Lighting Systems	September 8	10:00 - Noon
Today's slide deck and pre can be found on		irses
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