Lighting & Lighting Controls

SUMMER EDITION

CONSULTING - SPECIFYING engineer eBOOK | SYNAPSE

Contents

SYNAPSE

How lighting control systems contribute to flexible, future-proof buildings

Lighting control systems play an important role in buildings that need to address future challenges, both predictable and unanticipated

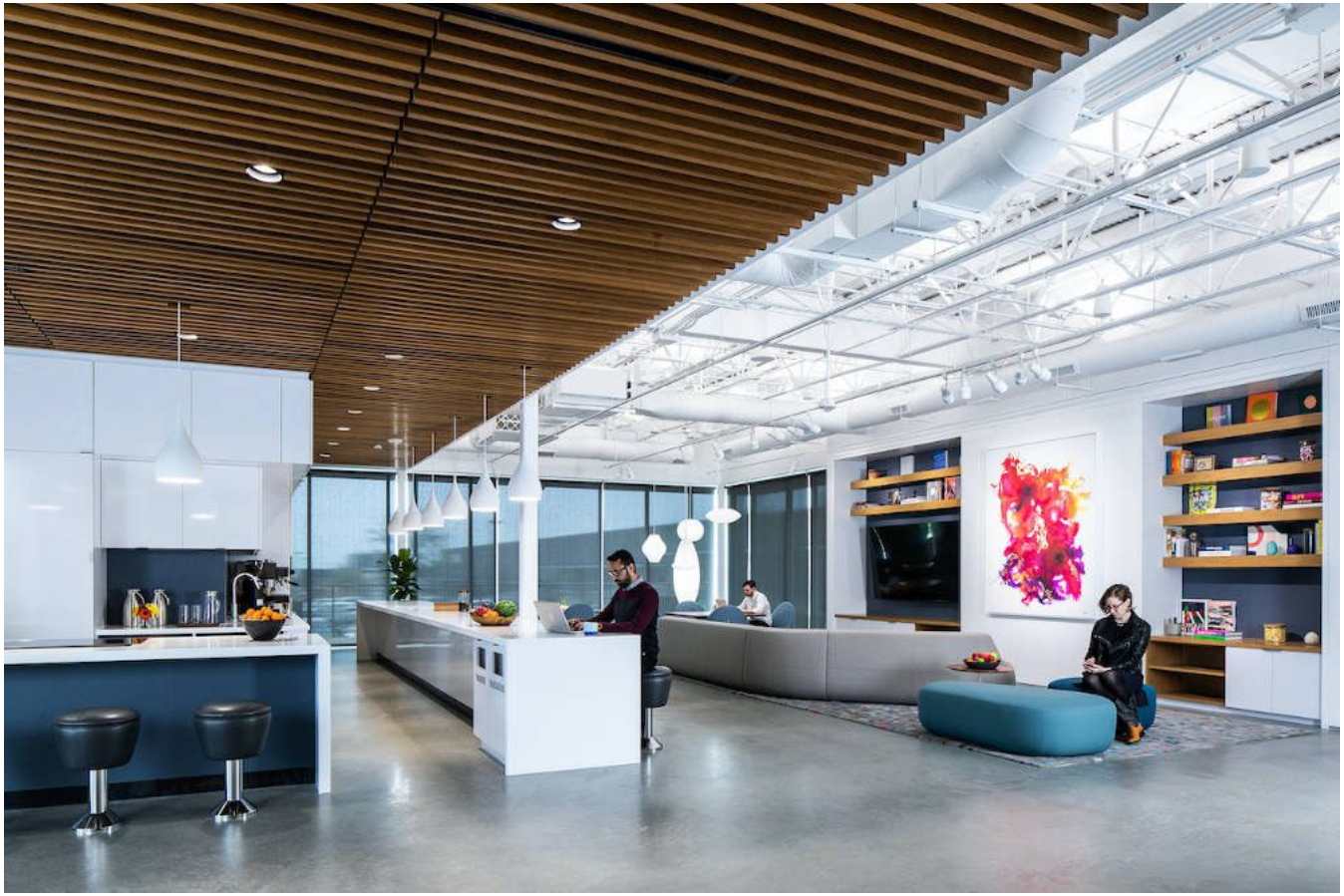
The U.S. Green Building Council defines resilience as "the ability to prepare and plan for, absorb, recover from and more successfully adapt to adverse events." We see engineers and owners prioritizing resilient building systems in new construction and renovations, especially in response to the COVID-19 pandemic and the unprecedented accommodations that had to be made in many commercial spaces.

Lighting control systems play an important role equipping buildings to handle future challenges, both predictable and unanticipated. In addition to meeting the parameters of the USGBC definition smart, digital lighting control systems support resilience with solutions that are flexible and future-proof, simplify adjustments and quickly adapt to changing work schedules and new occupancy patterns over time.

Engineers are looking for ways to bolster building resilience, support their clients and incorporate best-practice design of smart lighting control systems. They need solutions that are technologically savvy enough to monitor and analyze system data, help reduce waste, promote comfort, enhance productivity and continue to add value over time.

Digital lighting controls promote building flexibility

Commercial spaces will look different moving forward. Smart, digital technology makes



Flexible lighting systems support resiliency in the workplace by providing a comfortable, productive, engaging work environment that can change and adapt over time. Courtesy: Lutron Electronics

it easy to design lighting systems that support new conventions such as continued social distancing, the increased demand for touchless technology and spaces that can be quickly partitioned and redesigned as needed. Lighting also contributes to buildings that embrace a connection to the outdoors with integrated smart shading and daylighting strategies. Lighting control is the one building system connected to each of these performance goals.

Individually addressable LED fixtures, advanced LED technologies and centralized, adaptable controls enable code-compliant design and enhanced system flexibility. As requirements evolve, lighting and shading systems will play a pivotal role in spaces that foster well-being and promote productivity.

To design systems that best serve your clients' needs, it is often necessary to go beyond the traditional, stand-alone system. Review the solutions you typically choose for basic code compliance and make sure you are taking advantage of the available digital and software benefits to set your client up for success.

Robust software is critical. Moving forward, system software should be cloud-updatable, able to quickly adapt to new challenges, changing occupancy patterns and a variety of building uses. The software should also easily accommodate programming changes by the facilities team without the need for factory support.

Wireless solutions make flexibility future proof. They offer all the advantages of smart, digital lighting control and the power to make systems easier to design, more intuitive to program and personalize and more flexible than wired technology.

Wireless also offers seamless integration with heating, ventilation and air conditioning, building management and other third-party systems and enhances control options for better usability. They use all the same devices as wired systems — fixtures, load controllers, keypads, receptacles, sensors — but with no communication wires, fewer power wires and less conduit making them easier and more cost-effective to design, install and adjust over time.

Connected, wireless solutions make an already flexible system easily scalable whether the client expands over time or wants to consolidate space in response to trends such as hybrid work or remote learning. Add controls and sensors exactly where they are needed with no additional wiring or opening up walls. Centralize control and system management over multiple areas or buildings, making changes in minutes using a convenient app. The benefit is the opportunity to adjust quickly and seamlessly.

Wireless lighting control technology provides installation flexibly, allowing you to locate controls on typically challenging surfaces such as glass with no backbox or wiring. Courtesy: Lutron Electronics

Advantages of wireless lighting controls

With wireless, digital control it can be easier to update traditional solutions and to integrate today's advanced LED technologies as well as the next smart-source innovation into a high-tech project. The technology also accommodates the integration of smart assistants, voice control and system automation. Wireless capability and performance have come a long way since their introduction more than 20 years ago and have proven themselves in the field by delivering reliable, scalable, future-focused control for more resilient buildings:

- **Design flexibility:** With wireless, you eliminate many decisions about wiring and power requirements. And, when the project specification changes, the lighting control system can accommodate without going back to the drawing board.

- **Control/installation flexibility:** Wireless controls and sensors can be wall-mounted, ceiling-mounted or free-standing and they can also be used in locations that are traditionally challenging when it comes to control including glass doors and dividers, door jambs and even on podiums and furniture — no backboxes or new wiring required. Additional points of control can be added in minutes and sensors are easily repositioned to ensure best performance.

- **Faster installation:** Wireless systems install up to 70% faster than wired. This is a big plus for commercial contractors who are struggling with skilled labor shortages, supply chain challenges and unprecedented scheduling demands.

- **Simple set-up:** Certain wireless systems offer simple button presses or app-based setup and enable changes in real time, right in the space. With just their smartphone or tablet, the building facilities team can easily reassign keypads and zones to adjust to new space layouts or employee requests.

For future-proof design, consider performance over protocol

Once lighting designers commit to using a wireless system, they can focus on desired system goals — performance, reliability, scalability, security, integration, pricing, product availability and available service options. Then, work with a manufacturer who can help meet your needs and overcome objections rather than adhering to a specific protocol.

A building's smart lighting control system should provide the same code-compliant, reliable, easy-to-use experience your client expects from any lighting system and enhanced with all the data-driven building management power they have come to need in an efficient, comfortable building. Specifiers may lean toward open protocol systems for several reasons:

- They may feel that open-protocol design alleviates concerns about being permanently linked to a given manufacturer. Manufacturers can go out of business, obsolete a product line, change their service agreement or even be acquired. An open protocol can seem like a smart hedge against these concerns as a perceived back-up, of sorts, when it becomes necessary to replace a component or augment the system with another manufacturer's open-protocol product.

- To offset concerns about proprietary system pricing. Using an open protocol, the assumption is that if one manufacturer increases pricing it is possible to substitute with another manufacturer's equivalent product. This concern has been amplified in recent years as some companies have instituted significant and frequent price increases. Specifiers do not want to compromise their professional reputation or their client's budget and system performance.

- Because open protocols are more regulated, they can be perceived as offering elevated system security and the best option for achieving seamless, secure integrations between different building systems.

But these assumptions can be problematic. When you are deciding on a system, be wary of these open-protocol assumptions — "open" is a matter of interpretation. Many

manufacturers' systems start with a standard protocol, such as Zigbee, but then customize the code to meet their use case, potentially negating the openness the engineer intended to design into the lighting specification. The wireless communications may be based on an open protocol, but now you cannot swap out one manufacturer's device for another because the solution has been customized. You also do not get the advantages of a system optimized for your project and you may see degradation in performance, responsiveness, reliability and scale.

Wireless lighting control systems require less physical wire, making them easier to design and install while still supporting energy code requirements. Courtesy: Lutron Electronics

Proprietary, manufacturer-specific protocols, on the other hand, are designed to be optimized for a specific purpose and to take full advantage of digital network resources. These systems are engineered to meet well-defined performance criteria, ensure reliability for the life of the system and scale seamlessly to large installa-

tions without performance degradation or interference with other wireless devices such as Wi-Fi access points and Bluetooth headsets.

It is also important to think about how easy it will be to address maintenance and replacement issues down the road. If a driver or fixture fails, your clients need assurance that their system will respond as expected. Ultimately, you should be able to count on the system manufacturer to articulate the benefits and pitfalls of their designs and explain how it will support your application while meeting performance expectations.

As a specifier, protect yourself and your client by working with a manufacturer with a proven track record of customer care, demonstrated business longevity and a history of transparent, consistent pricing without drastic fluctuations.

Resilient lighting control architecture

Fixture-based, luminaire-level lighting controls (LLLCs) are another trend in smart, flexible building system specifications. LLLCs can be simple to design and install, but when it comes to system flexibility and resilience, zone-based control may be the more practical option over time.

LLLCs are lighting control devices integrated into the lighting fixture itself. Because these devices are typically factory installed, they can simplify some design considerations and reduce installation time. However, since the control is physically embedded into the fixture, it is not simple to swap out one LLLC for another. If there is a failure in the embedded controller, for example, you are likely to need to replace the entire fixture — a process further complicated by ongoing supply chain challenges. Because the LLLC is installed in the fixture at the factory, it is not likely to be available from stock

and probably requires a lighting rep to provide a quote, potentially adding time and cost when a client needs a quick, effective solution.

In contrast to the LLLC-based hardware approach are wireless, zone-based controls. These solutions typically have a wall- or junction-box mounted solution where one device controls a group of standard LED fixtures using an open protocol like 0-10V or phase control. They are not embedded in the fixture, which means you should be able to independently install or upgrade the controls and fixtures.

Using a zone-based solution, in the event a component fails you can easily install an in-stock, readily available, off-the-shelf replacement in just a few minutes. And, if one of the standard 0- to 10-volt fixtures or drivers fail, you can usually find those components at your local distributor instead of having to wait for a rep to quote and a manufacturer to custom-build the LLLC-based replacement fixture.

Zone-based systems typically require fewer components than fixture-based solutions, may be less expensive to install and often allow the client to upgrade or repair devices quickly and easily. A zone-based, digital, wireless lighting control system can easily accommodate facility expansion and the software is likely to be cloud-updatable.

Smart, wireless lighting control solutions add value, longevity to projects

Protect your clients and your projects by specifying a lighting control system that promotes building resilience. A smart, digital, wireless, zone-based solution, built on a carefully chosen protocol can help to future proof projects and increase flexibility, ultimately leading to a building that is better equipped to handle future changes.

Specifying the right system for each job starts with laying out all the design considerations — reliability, responsiveness, security and scalability — asking the right questions about integration, remote system access and system resilience and making sure the manufacturer you choose has a history of service and support that meets your client's needs now and into future.

Matt Ochs

Matt Ochs *is senior director of commercial business for Lutron Electronics.*

Seven ways MEP engineering can make your older building more efficient

MEP design engineering tips to live by

Below are seven strategies that you can use to make your older building more sustainable while also complementing and preserving the character and design of the structure.

1. Perform an energy audit

Before installing new equipment or making upgrades to enhance an older building' sustainability level, owners and facility managers should first perform an energy audit to determine if existing systems are operating at optimum levels.

Leaks, clogged or dirty filters, disabled sensors, faulty or incorrect wiring, or a lack of knowledge on operating and maintaining equipment among the maintenance staff can lead to increased costs and inefficiency. MEP consulting engineers can identify opportunities for improvement in each of these areas, as well as in a building's water systems, which can waste water and energy if they leak or operate inefficiently.

2. Retrofit windows

Windows play a major part in conveying the overall aesthetic appeal and character of an older building. They were often custom fit, and replacing them with new windows could require changing the size and shape of the opening. The installation of new win-

Courtesy: Peter Basso Associates, Inc.

dows also uses greater amounts of energy and resources, from materials used during production, to fuel used during transportation, to the disposal of old windows.

While all these factors make for a strong reason to keep your old, visually-appealing windows, chances are they aren't functioning at a very eco-friendly level. Retrofits such as cellular shades, storm windows, and insulating shades can help stop any air leaks and improve a window's energy performance. Adding weather stripping or caulking to drafty areas around your windows can also be a good first step to increased energy savings.

3. Reduce air leakage

In addition to windows, there are a number of other areas that can be responsible for air seeping into and out of an older building, which increases heating costs in the winter, cooling costs in the summer, and allows damaging moisture to collect inside your building. The tops and bottoms of exterior walls, open cracks at the bases of walls and around windows and doors, recessed lighting fixtures, and the intersection of walls and attics should all be sealed in order to curb air leakage and make your building more energy efficient.

4. HVAC upgrades

Upgrades to heating, ventilation, and air conditioning systems that include making use of natural ventilation and natural heat sources; minimizing energy losses in conventional systems; integrating new efficient technologies into HVAC operations, and many other methods all help to make HVAC systems more proficient.

There are a number of ways that buildings can achieve greater HVAC efficiency, from upgrading to thermal storage or free cooling systems to utilizing sensors and automating HVAC operations in order to function at optimal levels.

Installing HVAC ductwork in older buildings can require some thoughtful routing, configuring and concealing to maintain the building's aesthetics, meet code requirements and comfort standards. Fan coil units are often used to replace radiators in historic building because the pipes are smaller and less intrusive than forced air systems. Vertical-routed ductwork is also an option for preserving vaulted ceiling where little or no space is available above the ceiling.

In any instance, the design process should give careful consideration and planning to installing equipment in areas that will be hidden from view and/or effectively complement the theme and aesthetics of the building.

5. Increase insulation

Reducing heat transfer through a roof or attic space is a very effective approach to reducing energy consumption. Heat loss and gain caused by differentials in interior and exterior temperatures is greatest at the top of a building, and can be more pronounced in older buildings that may be need some structural upgrades to go with fresh insulation. Adding insulation to unfinished attic spaces will not only provide energy savings, but is also generally easy to install and causes minimal disruption to a building's historic features.

If your basement is part of your building's thermal envelope—it receives hot and cold air from your HVAC system—insulating floors, walls and vents will help to reduce energy use and manage moisture. If the basement is outside of your building's thermal envelope, insulating between the floor joists on the underside of the subfloor is generally recommended.

Wall insulation throughout your building can improve its thermal efficiency, but could cause damage to historic features and designs. Installing blown-in insulation into wall cavities causes the least amount of damage to historic features, but this option should only be pursued after roofs and basements are sufficiently insulated and an analysis is conducted to make sure wall insulation would be cost-effective.

6. Upgrade equipment and appliances

In addition to upgrading HVAC system components, building owners and manager can recognize greater levels of energy efficiency and cost savings by upgrading other

equipment, such as water heaters. High-efficiency water heaters use far less energy than older models, and other types such a solar-powered or tankless water heaters can offer even more significant savings.

If your building has older refrigerators, dishwashers, washing machines, or other appliances, upgrading these to newer, more energy efficient models will reduce electricity use and lessen indoor heating and cooling loads.

7. Utilize renewable energy

With solar and geothermal energy, owners and managers of older buildings can add environmentally-friendly and cost-effective energy sources that require minimal aesthetic and structural alterations. These strategies should be implemented only after other upgrades have been implemented and a thorough analysis determines their cost-effectiveness.

Solar panels can be installed in places with limited or no visibility, such as on a flat roof at a low angle or on a secondary roof slope. Solar collectors can be used to heat water and photovoltaic panels can convert solar radiation into electricity.

Geothermal systems require less equipment space, have fewer moving parts, and maintain better internal humidity levels than standard HVAC systems. By using the earth's heat as its source, a geothermal system can reduce a building's emissions and energy consumption while providing quieter operations and greater long-term savings than conventional HVAC systems.

Peter Basso Associates

Uline and SimplySnap Wireless Controls

Uline is the leading distributor of shipping and packaging solutions to businesses throughout North America. Family owned for over 40 years, Uline has built its brand on customer service. Order accuracy, quick delivery, and low prices are the core of their promise to their customers.

Cybersecurity needs for connected building systems

Connected building systems offer exciting opportunities for the industry, but they also bring cybersecurity risks designers and manufacturers may not expect.

Connected capabilities offer a great deal of potential for building systems. Connected HVAC, lighting, alarms, fire protection and more are all key components of smart buildings currently in demand. These capabilities offer exciting opportunities for the industry, but they also bring cybersecurity risks that may be new or unfamiliar to designers and manufacturers. Cybersecurity concerns may be new for these industries, but they are very real.

Cybersecurity influences more than just an individual system, its related products or devices. Connected systems have the potential to act as a gateway to other "internet of things" products, servers, networks and important data. Issues with one system or a product within it, can expose other systems and devices. A compromised lighting system can expose and put at risk HVAC, security, information technology and more.

In commercial settings, client or customer data and information could be exposed and in a residential setting, personal information could be in danger.

Breaches in building systems could present in any number of ways. A 2013 data breach where 40 million credit cards were exposed, for example, started with a compromised HVAC system. Reported flaws in lighting systems have shown it was possible to compromise Wi-Fi networks, in turn putting personal data at risk, particularly on unpro-

tected networks. Authorization bypasses, network/data exposure and vulnerability to hackers are all real concerns when it comes to desirable, technologically advanced connected products and systems.

To help mitigate risks from connected systems, engineers and manufacturers must take proactive cybersecurity measures to keep individual products and the connected ecosystem as safe and secure as possible. Cybersecurity should be integrated into the product at all stages—from concept to ongoing use.

The problem is many connected products and systems are not designed with cybersecurity in mind and they aren't independently assessed for cybersecurity very often. Instead, connectivity is often introduced as an add-on or upgrade to existing products not originally designed for the online world. Then they are sent out into a connected world without proper protections in place.

Proactive cybersecurity measures are a must for connected building systems. This includes risk management, testing, certification, continued vulnerability assessments, patches and security updates. The first step to ensuring a functional and secure system is understanding the various cyber threats present in today's landscape. These threats are becoming more sophisticated, complex and prevalent, all at a time where concerns around data protection and privacy are growing.

The threat landscape

Cybersecurity threats can range from various types of malicious software (malware) to human activities—both attacks and human error. Add to the mix increasingly sophisticated technology, like artificial intelligence or machine learning, as well as the ability to

run high-volume attacks and the risks increase. To best combat the threat, it is essential to understand what the risks are and where they come from. Familiarity with the threat landscape is the first step in ensuring system security.

Malware

Malware includes executable code, scripts, active content and other software designed to damage a computer, server or network. It is often encountered in the online space, with many high-profile breaches and hacks having links and origins in malware. Several subsets or types of malware commonly affect IoT products:

- **Botnets:** A network of compromised devices remotely controlled by an attacker to conduct attacks such as distributed denial of service or to steal data, send spam or access other devices and/or connections on internal networks.

- **Ransomware:** Malware that holds data, systems or devices "hostage" unless a ransom is paid. These incidents are on the rise, with critical industries like health care and infrastructure being especially vulnerable as seen with recent attacks on US gas pipelines. In extreme cases, ransomware attacks on critical systems could even result in injury or death. The Director of the FBI has compared the recent ransomware activity in the U.S. to the 9/11 terror attacks.

- **Worms/viruses:** A worm or virus is malicious software that replicates itself. Replication does not necessarily rely on any human interaction; it is often spread using the network. Impact can vary from mild inconvenience to significant damage, including system failure, data corruption, wasted virtual resources, increased costs or data/information theft.

- **Spyware:** Spyware infiltrates devices and networks to steal data and other sensitive information. Spyware is one of the most common threats on the internet with individuals, businesses and organizations vulnerable to attack.

Human activity

Behavior by humans is also an important consideration for connected products and systems. This might include malicious activities such as coordinated attacks where perpetrators seek out a vulnerability or weakness to access networks, devices, information or services. Examples include denial of service — an attack that has grown in popularity where an attacker looks to make a device or network unavailable by disrupting services of a connected host — and web-based attacks, where security holes in websites, applications or application programming interfaces are exploited to get unauthorized access to devices, networks or servers.

Phishing, a fraudulent act that accounts for nearly 90% of social attacks, can be used to harvest credentials, access IoT devices and data or otherwise infiltrate a connected ecosystem. Phishing is not only a coordinated attack, it is also brought about due to user error because the perpetrator has tricked a target into sharing information. Lost or stolen devices and inadequate cybersecurity measures also are examples of how human activity can make connected systems and their networks vulnerable.

Whether a coordinated attack, an honest mistake or a viral threat, cybersecurity concerns are very real and can have impact ranging from mild inconvenience to major disruptions and damage. However, these risks can be countered with secure products that undergo comprehensive testing and, in some cases, certification.

Peace of mind

Secure products are a key component of combating cybersecurity risks. Thorough testing and certification of systems helps ensure connected systems, their components and their data are as safe and secure as possible. Manufacturers can have products and systems assessed to a range of industry standards; optional assurance tests can also be critical to ensuring and illustrating cybersecurity.

Standards-based security

There are several standards that can be used to assess connected devices, depending on product type and the desired market. These standards can vary based on product type, intended use, testing goals and overall situation, so it is important to understand which standards may apply to a given system, as well as which certifications may be required for a market. Potential standards for connected systems include:

- **Internet of Things standards:** The IEC 62443 and UL 2900 families of standards apply to connected products (and systems) used in the home, commercial settings, medical devices and security and life safety. They provide a framework for assessing cybersecurity vulnerabilities, including requirements for technical assessments and acceptable standards. Connected products must be tested to the requirements established in the relevant standards. Products shown to meet the requirements can be certified, illustrating their compliance.

- **Cryptography:** The Federal Information Processing Standard 140 is a U.S. standard for secure cryptographic implementations. Though it is a U.S. standard, it has gained worldwide recognition as a de facto cryptography standard and certification, making it a good guide for other markets. FIPS certification is a required

for products or systems intended for the U.S. federal government and it is recommended for the Canadian government.

- **Common criteria:** Also known as ISO 15408, the common criteria set of standards often focuses on more traditional information communication technology products. The standard, which is internationally used and accepted, is designed to specify and IT security through functional and assurance requirements, as well as product and system specifications and evaluation. Common Criteria certification is recognized by more than 30 countries, including the U.S., Canada and many countries within the EU. It is recommended for IT products used by government entities and for critical infrastructure.

- **ISO 27001:** Organizations using a risk management system focused on information security are eligible for certification under ISO 27001, which covers people, processes, technologies and facilities used in daily activities. Compliance requirements include conducting a gap analysis, as well as creating and implementing an Information Security Management System.

- **Standards that are uniquely targeted** at consumer products and are built upon a widely accepted security baseline. An example is ETSI EN 303 645, which covers safety-relevant products like smoke detectors, door locks, alarm systems and automation systems and includes 13 provisions for security and five specific data protection provisions.

Assurance testing

Optional assessments can also be used to illustrate security and resiliency by testing

based on industry best practices. Often, these voluntary evaluations provide peace of mind and enhance a product's appeal. They include:

- **Private certification schemes** can help manufacturers demonstrate robust, on-going security over the life of a product or system, by monitoring new, emerging risks that relate to the product. Other cybersecurity testing schemes can also be used to illustrate cybersecurity considerations have been made in developing the product. As a voluntary assessment, the requirements and provisions for each scheme can vary.

- **Vulnerability assessments,** which evaluate susceptibility to known weaknesses and vulnerabilities, using specialized tools and detailed examinations to test systems, networks and cloud-based services. Assessments can also include evaluations against well-known communication protocols and applications. Results are interpreted in the context of a product's intended environment to understand risks at a practical level.

- **Penetration testing,** also known as ethical hacking, sees experts attempting to infiltrate networks, systems, products and applications. The approach provides an attacker's perspective and a detailed report identifies exploitable vulnerabilities and recommends mitigation, as well as strengths as successes.

- **Security design review:** Considering cybersecurity early in the design process is more cost-effective and efficient than trying to add security later in the process. Assessing security controls or network design for effectiveness and adequacy regularly throughout the design phase will help to ensure product security.

- **Privacy impact assessment:** A detailed review of organizational or product privacy policies and controls to ensure compliance to legislation and security standards. Assessments address the risks to privacy or privacy-related security that have been identified and considered, along with mitigation protocols.

- **Threat risk assessment:** A threat risk assessment identifies assets that need to be protected, the value of those assets and associated threats/vulnerabilities. It considers the impact of damage or loss and, most importantly, how to mitigate exposure or damage. A typical assessment will deliver a prioritized list of issues to be addressed.

Best practices

For any connected device, best practices, industry-specific standards, testing and certification should all be used to ensure a secure product. First and foremost, keep cybersecurity risks and methods of mitigation in mind from the start. Include these considerations in mind throughout product design and development.

Adding security after the fact seldom works and ends up being more expensive over time. Instead, a product should be built to be intrinsically secure. Define all security requirements for a product, including what types of threats might exist to the product and vulnerabilities that might reside in the product. Then, consider what safeguards should be implemented.

Test for cybersecurity early and often whenever possible. This helps mitigate risks along the way, as opposed to saving it for the end. Testing throughout the development process will help to ensure you are not introducing security risks along the way.

Independent testing and security certification illustrate compliance with regulatory or industry requirements. An independent opinion confirms controls are working as intended, offering a competitive advantage. It also outlines roadmaps for security improvement, improved operating processes and identification of key business assets.

Creating a connected device can be a challenging task in a world where technology continues to evolve at a rapid pace. Ensuring adequate measures are in place to ensure the protection, integrity and resilience of products, systems, information and data is critical to success and building a brand. A proactive approach to leverage existing standards and undertaking additional assurance assessments, can mean the difference between a success and a failure.

Wayne Stewart
Wayne Stewart *is vice president of cybersecurity at Intertek, a CFE Media content partner.*

synapse

IT JUST WORKS.

RELIABLE, EASY-TO-USE, WIRELESS NETWORK LIGHTING CONTROLS

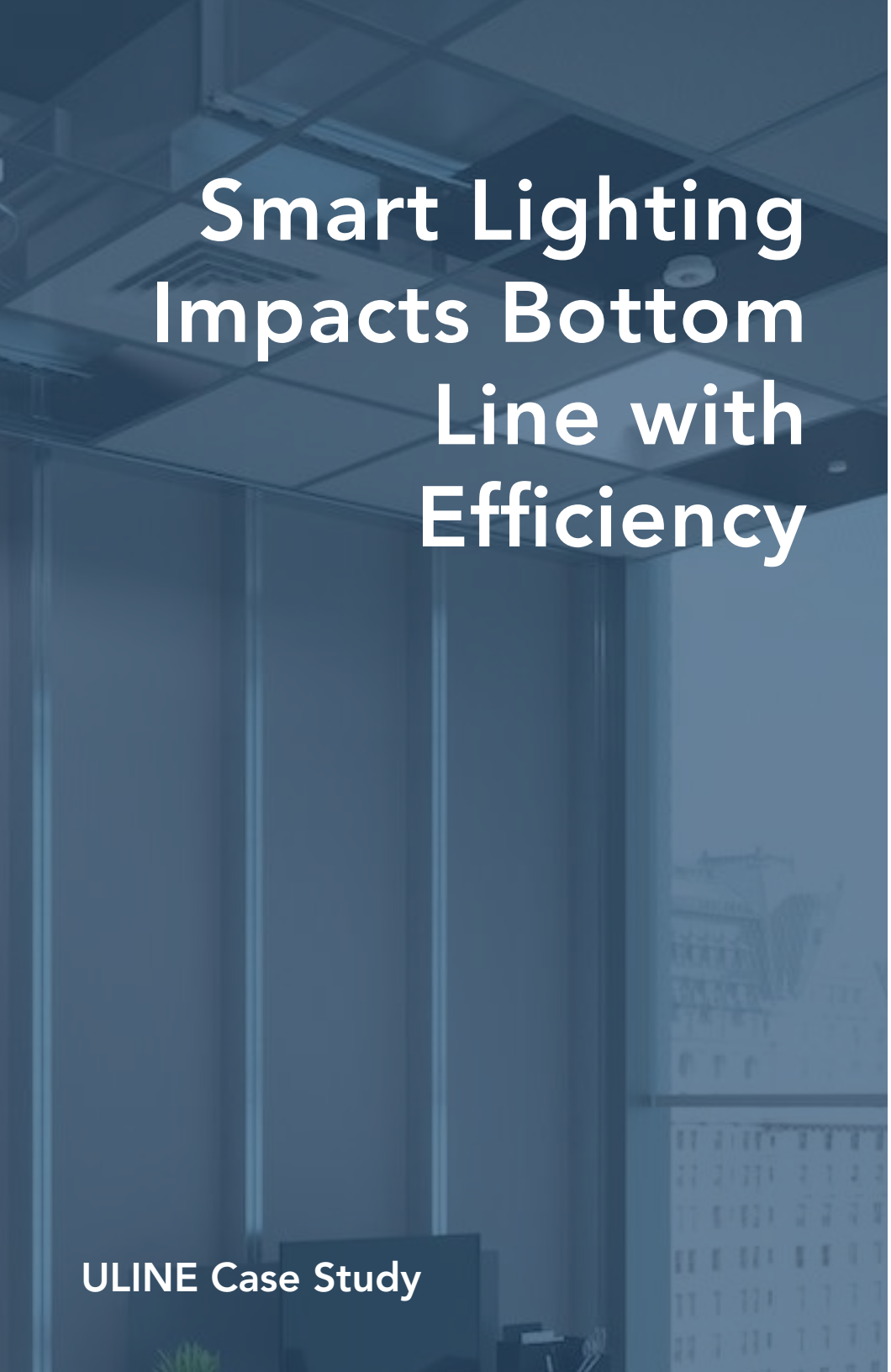
Embed Control in your LED Luminaires.
Simple, Secure, and Scalable.

- Parts In-Stock
- Energy Code Compliant
- On the DLC Qualified Products List for Networked Lighting Controls

Request a Demo or Quote

DISCOVER WHY SYNAPSE IS THE IDEAL SOLUTION FOR PARKING GARAGES.

synapsewireless.com



Smart Lighting Impacts Bottom Line with Efficiency

ULINE Case Study

Discover how ULINE reduced energy use by 28% by implementing scheduling and controls strategies, met the stringent energy codes required by the state of Washington, standardized on SimplySnap for all new facilities, and met the performance requirements and successfully integrated with existing BMS system.

SITUATION

Uline is the leading distributor of shipping and packaging solutions to businesses throughout North America. Family-owned for over 40 years, Uline has built its brand on customer service. Order accuracy, quick delivery, and low prices are the core of their promise to their customers. With a robust, 800-page catalog and over 38,000 products, everything in their facilities is expected to contribute to this promise.

And by everything, that means each and every one of the warehouse's 3,014 lights.

Uline's director of Engineering, Mike McConnell, is tasked with finding efficiency wherever it may be hiding, and he understood the strategic importance of optimizing light to improve both operational and financial performance.

Uline needed the lighting at its facilities operating at its best - energy efficient, task tuned to enhance order accuracy and simple to operate. Mike wanted his team focused on moving product, not wrestling with technology. Each day, dozens of tractor trailers carrying tons of product are distributed from their 800,000 square foot Lacey, Washington facility. Uline identified a luminaire that best fit their facility's needs, but they had issues finding a reliable lighting controls provider that could deliver a solution at this scale to meet stringent energy codes and zoning requirements they needed. A few things were necessary: The lights in the entire facility had to operate as a single system with one interface, they had to adjust to natural lights from the skylights for daylight harvesting, and the technology needed to work with Uline's existing IT system.

> **"Everything that we put into these buildings has to speak towards our passion and advance our mission, which is to get you the right product, as soon as we can, and at the best price we can offer."**
>
> *MIKE MCCONNELL // Director of Engineering at Uline*

The facility consisted of hundreds of aisles, each needing their own independent zone. Having all lights in each zone come on at once was paramount; a facility of this size houses thousands of individual luminaires, and instantaneous light for each zone was top priority. When you're operating at peak efficiency there are several literal tons of product that must get to customers on a daily basis, you've got to be able to see what's in front of you - not in 10 seconds, but right now.

Other providers offered a mix of wired and wireless systems that were complex and cumbersome. The wired systems were hard to install and maintain. The wireless solutions couldn't scale to meet the size of the facility and were slow. None of the other systems could meet Uline's IT requirements, nor deliver the desired user experience of the control system: It needed to be reliable, and it needed to be simple to operate. With mounting energy costs and a bustling workload, Uline needed the Washington facility's lights to light the way. Mike didn't have time (or energy) to waste on complex solutions that didn't deliver optimality.

> "We had the top three lighting control companies in here trying to do wireless mockups. We wanted them to come in and perform, and show us that we could bring these lights on together, and they failed miserably."
>
> *MIKE MCCONNELL // Director of Engineering at Uline*

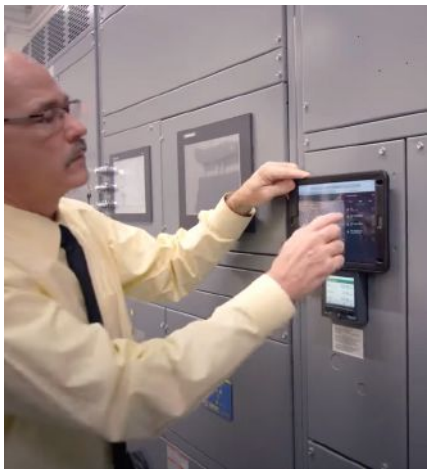
SOLUTION

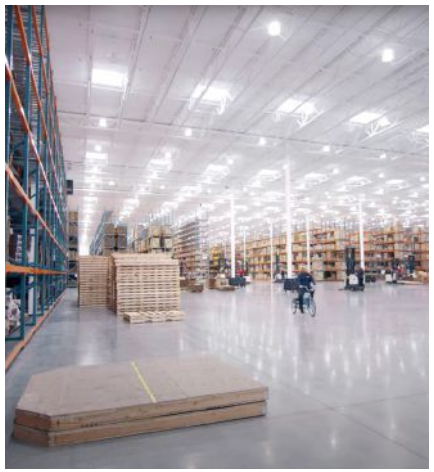
Synapse got to work on a smart lighting solution that would meet Uline's logistical needs and impact their bottom line.

3,014 high-bay luminaires were installed at the Uline facility and then integrated with Synapse's SimplySnap wireless controls. SimplySnap, is a scalable wireless platform that can manage multiple locations and single sites up to 10,000 lights. It allows Uline to set up, control, monitor, and manage every light from a single user interface that integrates with Uline's existing building management system (BMS).

The high-bay lights respond instantly without delay (check) and are optimized through SimplySnap's precision controls and scheduling to respond to the natural lights from the warehouse's skylights and enable daylight harvesting (check).

The SimplySnap lighting solution comprises software and hardware components that are adaptable to multiple applications, providing reliable connectivity and control. Our lighting controllers use the secure, and robust Synapse SNAP® mesh network, providing a dependable solution that just works – as promised, all the time. The intuitive control and interface allowed for the creation of custom settings and schedules, which maximized Uline's savings while giving them complete control of each light, bank, and zone.





The SimplySnap system worked so well at the Lacey, Washington facility that it was chosen as the standard system for all of Uline's future deployments, including parking lots, signage and building lighting.

> "I walked him through setting up the configuration, and he [Mike] was up and running quickly, controlling the lights from his iPad."
>
> *ROB PADGETT // Field Engineer*

RESULTS

- **Reduced energy use by 28%** by implementing scheduling and controls strategies.
- **Met the stringent energy codes** required by the state of Washington
- Met the performance requirements and **successfully integrated with existing BMS system**
- **Standardized on SimplySnap** for all new facilities

The SimplySnap solution addressed each of Uline's needs seamlessly: it's cost effective, energy efficient, simple to use and provides a well-lit, optimal working environment for employees.

And that's not all:

The SimplySnap solution also meets the stringent Washington State Energy Codes.

OUTCOME

800,000 SQUARE FEET

3,014 LIGHTS

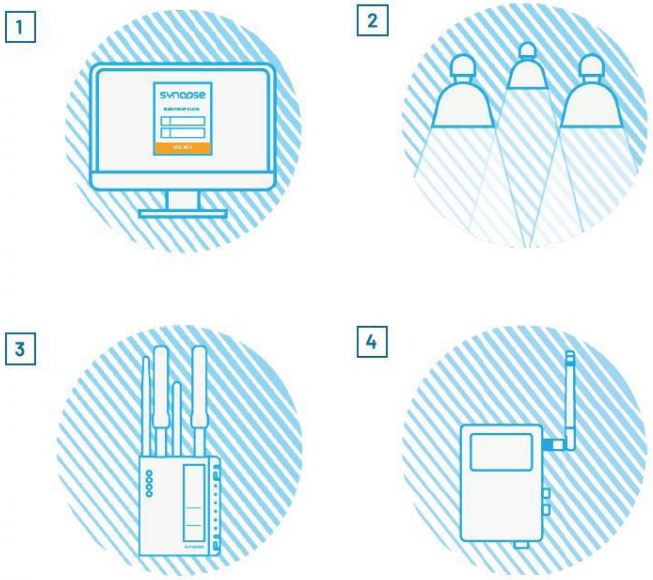
221 ZONES

563 MOTION SENSORS

BMS INTEGRATION
WASHINGTON ENERGY CODES: **MET**
1 MANAGEMENT PLATFORM - **SIMPLYSNAP**

SYNAPSE CONTROL PRODUCTS

1. SimplySnap
2. High-bay luminaire with embedded Synapse Controls
3. SS450 Site Controller
4. BMS Gateway



Visit **www.synapsewireless.com** to learn more or speak with one of our sales representatives

Lighting design in health care settings

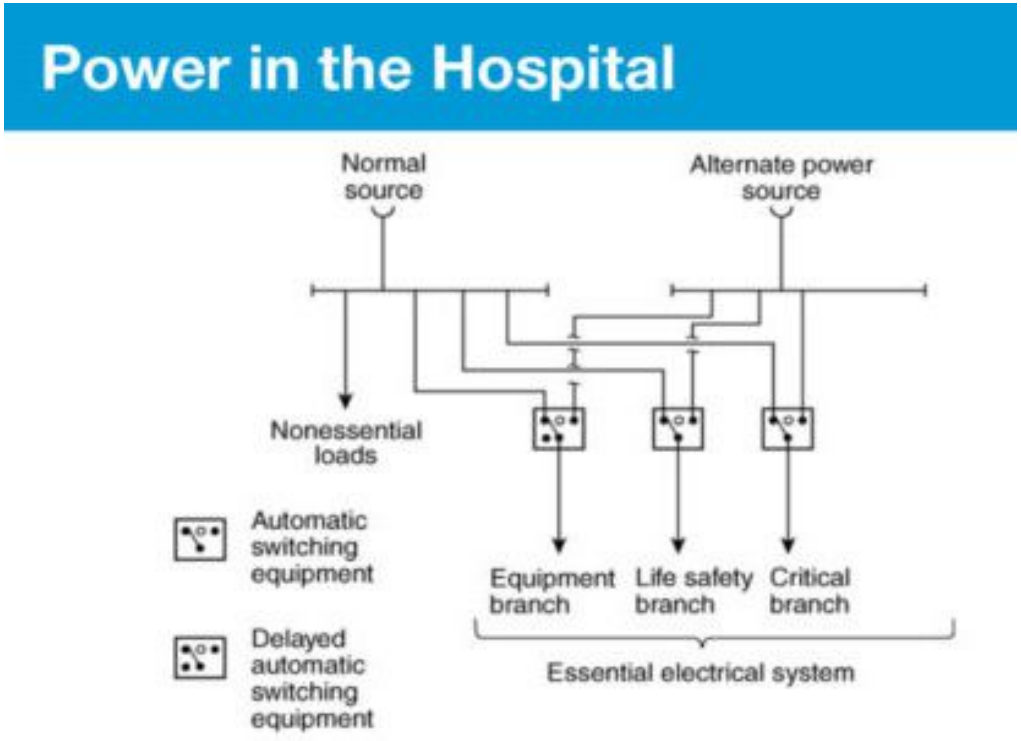
Advances in lighting and control technology are paving the way to more comfortable lighting that is intuitive and efficient for patients, their families and their health care providers

Over the past few years, health care facility design has become more focused on the patient experience. Two important and emerging trends supporting this evolution include giving patients more control over their environment and implementing flexible technologies that adapt over time to meet changing health care needs. Designing advanced lighting control solutions into health care projects can improve comfort, simplify control and make facilities more future proof and energy efficient at the same time.

Because patients spend most of their time and interact most heavily with providers, staff and technology in their hospital rooms, the patient room is a focal point of lighting design. Lighting can play an important role in creating a more inviting atmosphere, giving both the patient and the provider control over the mood, atmosphere and functionality of the space. Lighting that is more personal and accessible helps transform the room from a primarily clinical, sterile environment to a space that helps put patients and their families at ease.

While primary focus is on the patient, a positive experience is also critical to everyone who uses the space including nurses, doctors, other clinicians and hospital staff. How can you design lighting and control to best serve everyone's needs?

With a well-designed system, the patient can turn off over-the-bed lights to take a nap, while visiting family members have enough light to read. With the press of a button, a nurse can do middle-of-the-night bedside checks under dim light that reduces stress on the patient; touch a different button and all lights can come to full for an exam or emergency situation. The key is to enable the right light at the right time.



Typical power structure in health care facilities: Nonessential, Life Safety and critical. Courtesy: Lutron Electronics

How power interfaces with the lighting

Before getting into the details of a lighting control system, it is important to realize that power in a health care facility is different from power in a typical commercial space (for complete details, visit NFPA 101: Life Safety Code). Rather than normal and emergency feeds, there are nonessential and essential power feeds. Nonessential power is the same as normal power in a standard commercial building. Essential power is made

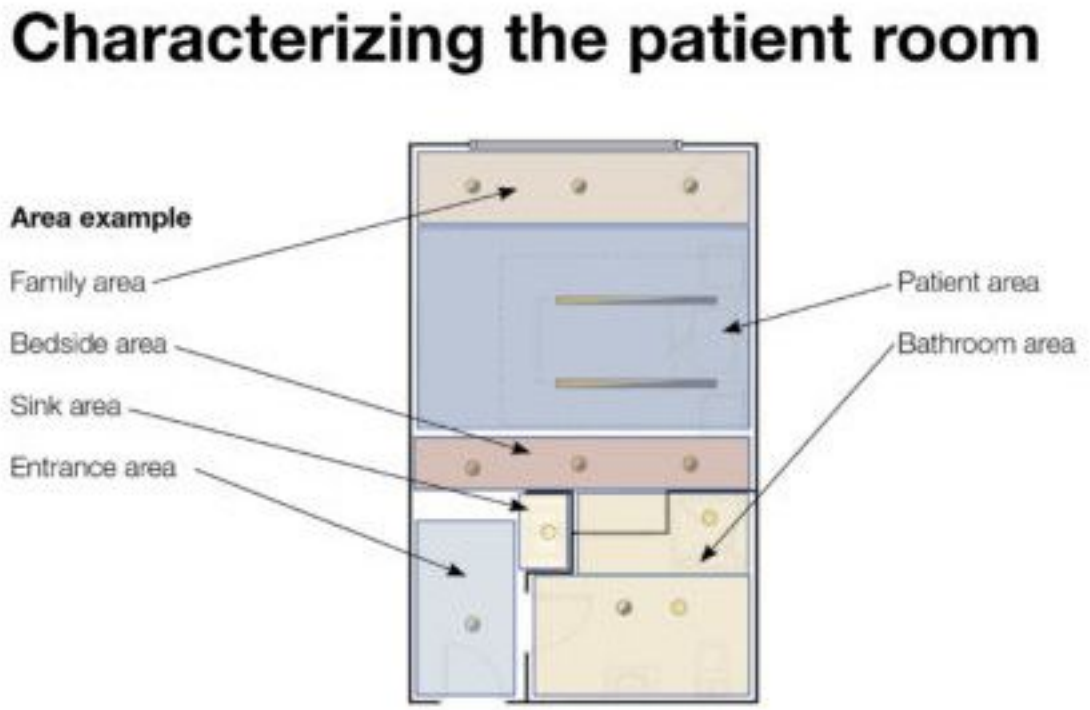
up of a life safety branch, similar to the emergency backup power in a typical commercial building, intended to support safe egress, as well as a critical power branch to keep hospital operations working normally under emergency power.

How the lighting control system interacts with these power systems deserves further explanation, starting with the critical power branch. Lights always function in the critical branch of the essential power feed. They continue to operate as they are programmed, with no lockout and no override, even under backup power and are used in areas such as operating and patient rooms that must stay functional during a power emergency.

During the loss of utility power, devices on the critical branch continue operating, uninterrupted and unchanged, for patient safety and support. Emergency room lighting, for example, can't just default to standard egress levels (often 100%); it must maintain the lighting level at the time of the power loss.

The life safety branch, on the other hand, is analogous to emergency power in a standard commercial building. These loads include exit signs and egress lighting and they are subject to lockout and override to maintain minimum light levels in an emergency allowing occupants to quickly and safely, exit the building. Nonessential or normal power is used for the remaining noncritical, nonlife-safety lighting and equipment.

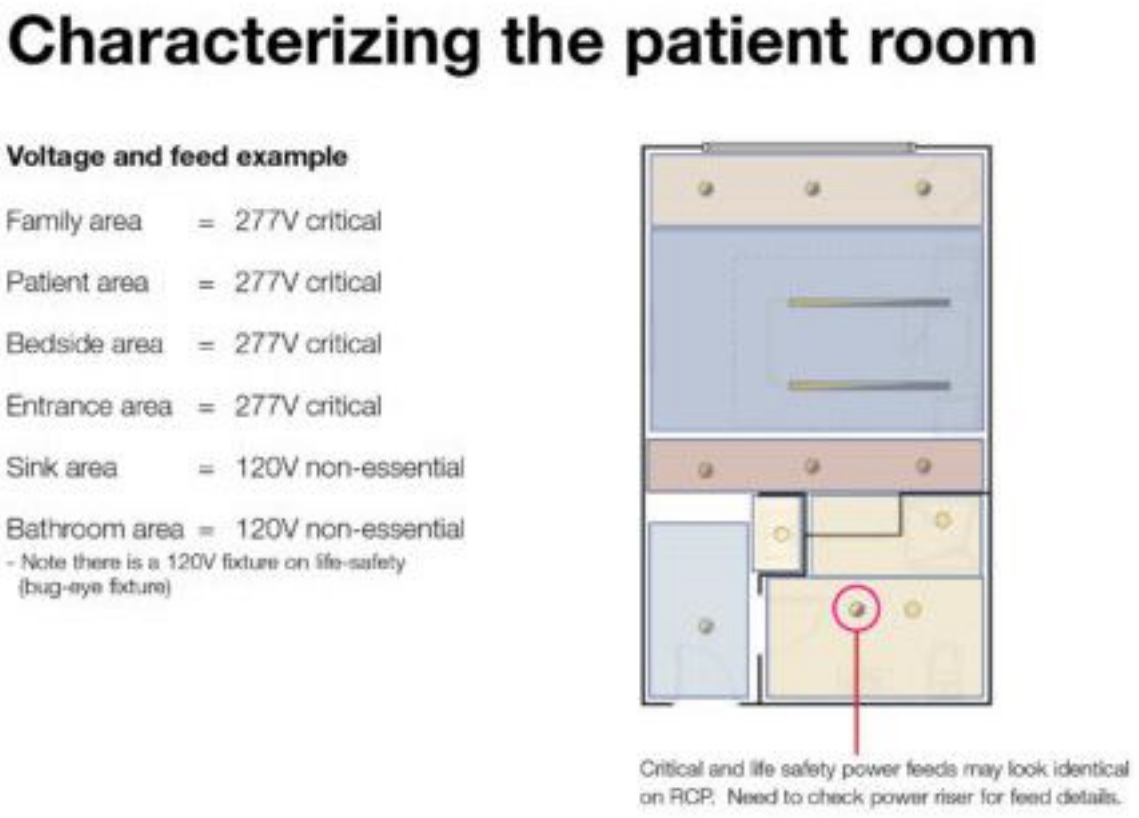
From the specifying engineer's perspective these circuit requirements and the need to account for three separate power feeds mean it is important to think about lighting early in the planning process. Patient rooms may have all three branches feeding them, but not all three branches may be used with the lighting control system. It is common



for only the critical and nonessential feeds to be used with the lighting system in a patient room. The life safety feed is often used only with a stand-alone emergency/battery backup fixture.

A hospital patient room will often incorporate between four and 12 lighting zones in multiple areas. Courtesy: Lutron Electronics

Multiple power feeds can complicate the installation as well. For example, the lighting design cannot mix the different power branches in the same junction box or in the control panel without proper separation and the definition of proper separation depends on the type of control protocol being used. For a 0 to 10 volts system, for example, you may need independent controllers for each power source.



A hospital patient room will often incorporate between four and 12 lighting zones in multiple areas. Courtesy: Lutron Electronics

For digitally controlled systems with addressable drivers, you can generally mix the control wires from different power sources without special barriers because the line voltage typically goes direct-to-fixture rather than to the controller.

However, the controller itself should be on the critical branch. Fixtures on a digitally controlled system may be entirely on the critical branch, but sometimes there may be some stand-alone light switches or dimmers on the nonessential feed.

A typical sequence of operations might look like this:

- Nonessential branch lighting operates as programmed when utility power is present. Lights must turn completely OFF when utility power is not present.

- Life safety branch lighting loads will be powered when utility power is present, can be turned ON or OFF at any time and can function as part of a system. When utility power is not present, life safety loads must meet minimum light levels in specific areas in the hospital, primarily for egress purposes.

- Critical branch lighting must function the same way regardless of utility power or backup power. For example, consider emergency room or operating room lighting — you would never want to lose control of your lights midsurgery, whether a generator or utility power is supplying the room lighting at the time. You just need the lighting to work as programmed.

Characterizing patient room design and layout

Despite their relatively small footprint, patient rooms accommodate many users and a wide variety of functions. A typical space this size usually has only one or two lighting zones, but a hospital patient room will often incorporate between four and 12 lighting zones. This zone density, together with the complexity of the different branch circuits, requires careful planning. Power, controllers and keypads all need to be coordinated early in the design process.

Lighting zones in a patient room are usually divided between three to five main areas:

- Patient/bedside area — Often this comprises two-to-four zones of light in a specialized, over-the-bed fixture and may also include shade control.

- Family/sitting area — Typically along the outside wall, this may include one or two zones of independently controlled lighting.

- Nurses' station/sink area — This may be broken into different lighting zones for a small desk/work area, exam lighting and room entry light.

- Bathroom area — Often has at least two zones of light for patient safety and comfort.

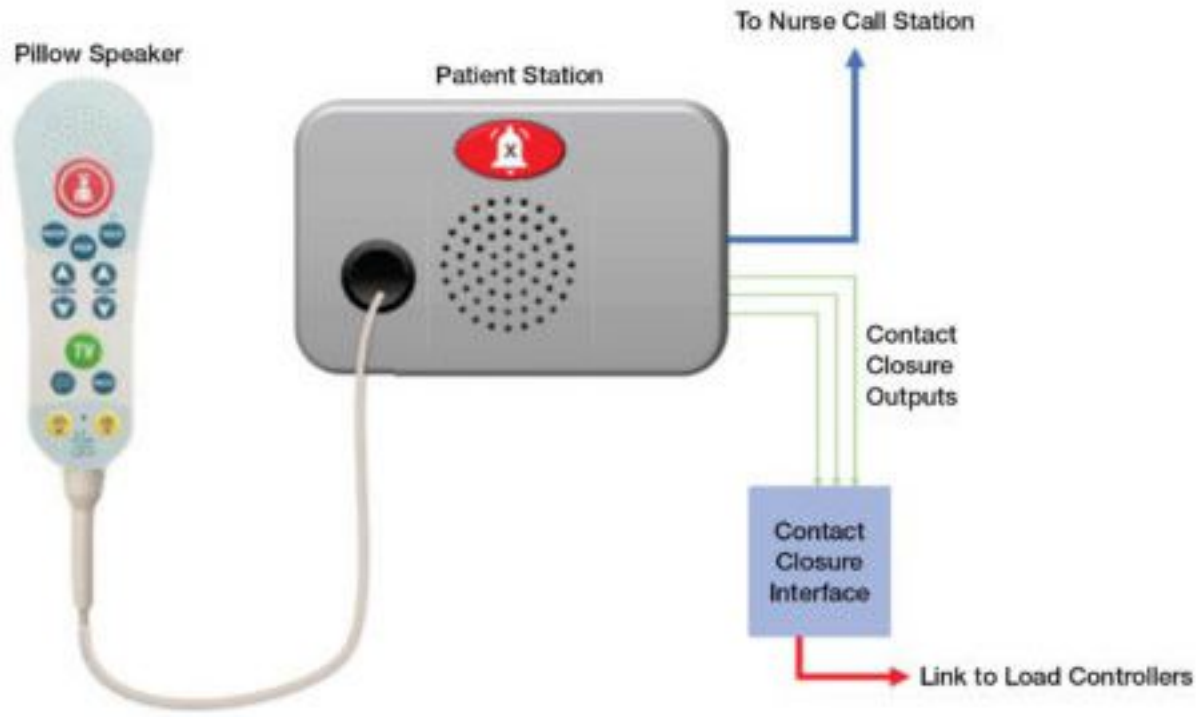
- Entrance area — Generally a single switched light.

A typical layout features different power feeds and voltages — 277 volts critical, 120 volts nonessential and 120 volts life safety are all represented in this lighting design example. Critical and life safety may have the same symbol on the reflected ceiling plan showing they receive backup power.

Reference the power plans to be certain whether the "emergency" designated fixture is fed from critical or life safety. It is also worth highlighting the battery-backup emergency fixture in the bathroom, which may not get controlled by the system or have local control, depending on the design of how that life safety branch is handled.

Benefits of digital control protocols for lighting

On today's typical commercial project, it's easy — and often standard — to specify



The key to pillow speaker control is coordinated integration between the lighting control and pillow speaker manufacturers. Courtesy: Lutron Electronics.

analog, 0 to 10 volts control, which provides hard-wired zoning that most designers and contractors are familiar with from other applications where the wiring defines the functionality (all fixtures that are wired together get controlled together). However, the high-density zoning requirements in patient rooms make digital control, where a single control panel could manage as many as 128 zones, an attractive consideration.

When overall material and labor costs are factored in a system that uses individually addressable, digital control methods — such as DALI, EcoSystem or wireless proto-

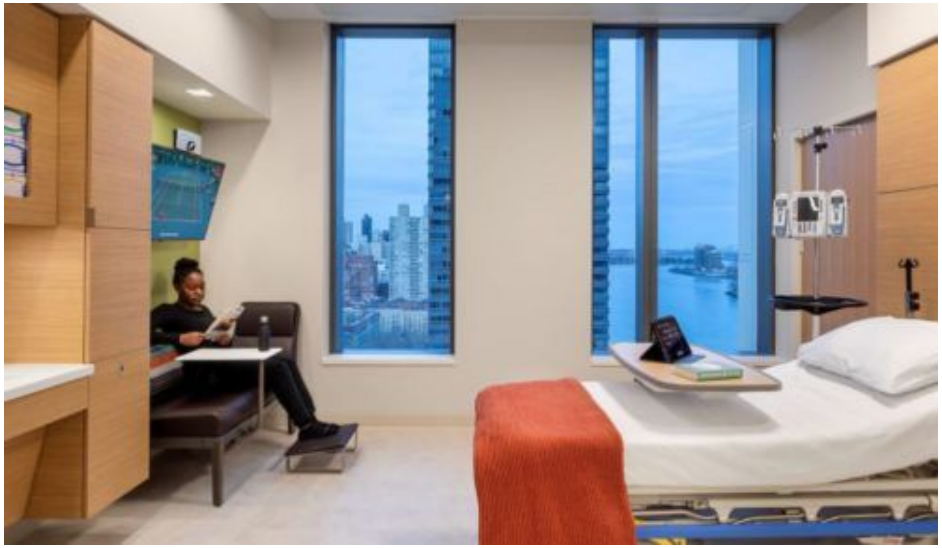
cols — can be the less expensive, higher performance alternative. With individually addressable fixture control, you need fewer control boxes, less conduit, less wiring and less time coordinating the lighting spec.

The sequence of operations in patient rooms can be advanced, with different lighting control scenarios required for patients versus care providers. These sequences require careful planning and often need multifixture control that is not easily accomplished with an analog solution. Analog wiring requires you to know the exact sequence at the outset of design, which can be unrealistic. A digital solution allows easy adjustments and rezoning, with no need to rewire, even after the space is in use; you can simply reprogram using software rather than calling an electrician.

Beyond capital expenditure savings, a digital control system can provide additional benefits. Flexibility and resilience have moved into the spotlight over the past few years. Many hospitals had to quickly adapt in the wake of COVID-19. In some cases, larger spaces had to be quickly subdivided to create individual patient room or isolation spaces. Capacity for patient care was compromised when spaces could not be easily reconfigured. For example, isolation rooms that are traditionally distributed throughout the hospital had to be consolidated in one area to ensure limited staff were able to provide necessary care.

A digitally addressable lighting control system can make it easier to redesign hospital spaces, allowing simple reprogramming of lighting zones to suit changing needs without the cost of rewiring a 0 to 10 volts lighting control system. Even the use of wireless control systems, historically excluded from health care applications, has seen broad adoption in many hospitals over the past few years, enabling greater flexibility and

lower installation and reconfiguration costs.



Consider all the expected use cases and develop your sequence of operations based on that information. Courtesy: Andrew Rugge, Perkins Eastman

Moreover, the medical staff may see the need to adapt the lighting overtime. As they learn their own teams' behaviors and patients' needs, the flexibility and simplicity of digital control offers the ability to intuitively make those changes as frequently or infrequently as necessary.

Having control over lighting

Why is there now so much focus on patient-room lighting? In a September 2021 Illuminating Engineering Society industry webinar, health care lighting design experts noted that during the COVID-19 pandemic, many people felt a loss of control over their own life situations and this gave providers and design professionals a new window of understanding about what patients may go through during a hospital visit. Patients and their families often deal with feelings of sacrificing control when they enter the hospital.

Giving them back some control over their environment, whenever possible, can lead to a better experience. Whether that's the simple ability to dim or brighten lights in the room, use motorized shades to adjust the amount of natural light or even control

the color temperature or brighten the room with saturated color, today's modern fixtures and control systems offer a broad array of solutions that can give the user more control and elevate their experience in the space.

Consider all the expected use cases and develop your sequence of operations based on that information. Courtesy: Andrew Rugge, Perkins Eastman

Researcher Andrea Wilkerson, lighting engineer/researcher for Pacific Northwest National Laboratory, and Brooke Silber, associate principal director of lighting for BR+A took part in the September IES webinar, and we share their timely insights here.

A study from 2020 points to the positive impact of light on behavioral health patients. Researcher Wilkerson is currently studying data in a behavioral health facility in which she is observing the number of times a patient adjusts his or her lighting. "We are getting objective data that helps us better understand a person's mental health, behavior and progress," said Wilkerson.

"Providing control in a behavioral health setting is empowering," said webinar panelist Silber. "Lighting plays an important role in creating this inviting atmosphere by setting

appropriate moods at the appropriate time, facilitating enhanced comfort, and maintaining a high quality of care."

While top-priority focus is given to patients and their families, specifiers need to consider all the people who use the space including nurses, doctors and other clinicians. What are their needs and how do they use lighting and controls? As researchers focus on the patient experience, it's becoming easier to discern specifically how a space is used and what each stakeholder needs.

Lighting hardware considerations

When it comes to controls in the space, patients and visitors need simple, intuitive control — akin to familiar residential controls — because that's what they are used to. Hospitalization can be disorienting enough without having to figure out how to do something as simple as turning on the lights in your room. Intuitive zone control, with familiar on/off buttons, potentially with raise/lower options, is best. If the room incorporates motorized shading for natural daylight, you'll also want to ensure those controls are obvious and simple to understand.

In contrast to patients, the doctors, nurses and staff use the space daily and can quickly learn advanced lighting control settings. Here, scene control can be extremely useful — a single touch to adjust lights and shades together can offer efficiencies to the care team. These scenes can be aligned with the typical tasks the medical staff perform, allowing them to complete them more efficiently — including evening check-ups, daytime exams or an urgent emergency.

Manufacturers offer a variety of control types that can easily be mixed and matched to

serve the needs of both patients and medical staff. Choosing the right combination of controls goes back to a familiar theme — start planning early and carefully consider the sequence of operations.

Bedside control is its own area of consideration and it typically centers around the pillow speaker. A pillow-speaker is a handheld remote control that allows a patient to call a nurse or control many things in the room including the TV, motorized shades and lighting without leaving the bed. The key to pillow speaker control is coordinated integration between the lighting control and pillow speaker manufacturers.

Integration methods can vary between simple contact-closure to more sophisticated network-based integration. Work with your selected vendors to get the desired functionality and the right control configurations, worked out. Like the wall keypads, simple control configurations are essential since many patients have little or no previous experience with these hospital-specific controls. Zone control that toggles a light on and off, easily indicated on the pillow speaker by a simple light bulb icon, is typically a great option.

Ensuring a lighting project's success

When lighting designers start a project, they should get the stakeholders together and define goals and budget up front for the greatest impact and to fully understand how the client expects the lighting control system to behave. Consider all the expected use cases and develop your sequence of operations based on that information. In today's projects, stakeholders often include some nontraditional players, such as IT departments that have concerns about cybersecurity, integration or remote access.

Another common practice in hospital design is to create a full-scale working mock-up of the room, invite stakeholders into the space and ask them to provide feedback based on a hands-on experience rather than just a hypothetical one. This often leads to better outcomes and fewer concerns once the final space is installed and operational.

Properly identifying application and stakeholder requirements is key to a simple, flexible lighting system that can make a positive impact and ensure long-term satisfaction. Starting with a well-designed specification helps to ensure that installation, programming and potentially reprogramming of lighting systems are as simple as possible, while providing patient and staff-friendly solutions that meet the ongoing needs of the institution.

Rick Walsh

Rick Walsh *is product manager, commercial systems, Lutron Electronics Co. Inc. He is currently focused on business development for the commercial market, with a specific focus on lighting control strategies and solutions for health care and global markets.*

Lighting design engineers look at LED lighting advancements in K-12 schools

New LED advancements provide a level of capability that previously had been inaccessible to school facilities. PBA and Illuminart explore the evolution of lighting from incandescent to LED

Today, LED lighting is often required in most new and renovation projects. Besides offering the obvious reductions in energy consumption and maintenance, LED systems continue to provide new and additional benefits. Previous leaps in the evolution of lighting technologies, outweighed the sacrifices that always came with its use. However, pre-electric times aside, the improved light sources always attempted to mimic the old faithful incandescent lamps. High intensity discharge lamps (HID), offered high lumens/watt efficacy, but with a poor color rendering index (CRI), inconsistent correlated color temperature (CCT), and an inability to turn on instantly; not to mention the noise, heat, and bulky hardware required to make it all work. Fluorescents continued with struggling CCT consistency and questionable CRI. Dimming was considered a 'specialty.' Neither of these advanced technologies were ideal, and drove lighting products to physically larger, bulky designs.

LED lighting has advanced significantly enough that we now have a light source that can mimic the characteristics of incandescent lights without sacrificing quality and aesthetics. We can turn them on/off instantaneously, without sacrificing life by frequent on/off switching. We can also dim LEDs while simultaneously lowering CCT, just as we could with incandescent. Like incandescent, LED retrofit lightbulbs are available in

frosted or clear versions that include visible filaments. Two items that technology still needs to improve are bulky drivers for LEDS reminiscent of ballasts, and the flicker often associated with dimming.

While there may always be a place for a variety of 2×4 light fixtures in classrooms, the LED versions are thinner, lighter, easier to install, visually more comfortable, and far more energy efficient than the traditional versions. Much like the explosion in technological advances with LEDs, manufacturers continue to expand the extensive types of LED products that are available to consumers.

Educational facilities are all about learning and inspiring curious minds. LED systems provide an opportunity to support such environments by helping us create visually intriguing spaces. Media centers, collaborative/common spaces, vestibules, exterior facades to name a few, can be designed much like non-educational venues. For example: commercial theaters, entertainment centers, museums, and other commercial/public spaces. Such spaces often required combinations of HID (for performance) and incandescent or fluorescent, to accommodate dimming, accent lighting and life safety instant-on requirements. Some of these functions can be combined using LEDs. Today, there are multiple shapes, colors, lighting distribution and dimming options to choose from that enhance the visual appeal and function of such spaces, making them more interesting and appropriate for evolving age groups.

While LED technology evolves, education facilities also require adaptability. Students with special needs may require rooms with a broad range of lighting functions; with each human condition requiring a different set of lighting preferences.

Multiple layers of LED lights with good optical control, combined with programmable digital lighting controls, can provide educators with the flexibility required to accommodate many unanticipated conditions. Spaces can also be partitioned into bright-to-dark versus areas of active-to-calming. Moreover, window shading can be used for complete black-out needs for nap time or for presentations, for example.

LED and controls technology simplify the ability to make lighting changes throughout the day, either automatically or manually.

New LED advancements provide a level of capability that previously had been inaccessible to school facilities. Educating administrators and the design community, in the complexities of LED systems will help them better prioritize decisions when designing education facilities.

Lighting designers and engineers that are informed and experienced, can provide guidance to the right LED system solutions for facility or spatial needs.

Robert White, Darko Banfic, and Scott Peck
Robert White, *IALD, LC, IESNA,* ***Darko Banfic,*** *LC, IES and* ***Scott Peck,*** *PE*

Lighting & Lighting Controls

Thank you for visiting the Lighting & Lighting Controls eBook!

If you have any questions or feedback about the contents in this eBook, please contact CFE Media at *customerservice@cfemedia.com*

We would love to hear from you!

SYNAPSE

Content Archive