LLLC
Luminaire-Level Lighting Controls

RESOURCE

Sequence of Operations: Why It Matters for Lighting Controls to Perform as Expected

WHAT IS A SEQUENCE OF OPERATIONS?

A Sequence of Operations is the "rulebook" for any lighting control system. It outlines how the system should behave — when lights turn on or off in response to daylight, occupancy, and unoccupied times. The document ensures that everyone involved, from manufacturers to programmers to building occupants, knows what to expect during design, installation, and occupancy.

Typically derived from a Control Intent Narrative, the Sequence of Operations provides the technical details needed to program and explain the advanced lighting system's functions. It offers clear, step-by-step instructions for how the system should operate in various scenarios, answering not just *"What should it do?"* but *"How will it do it?"*

WHY IT MATTERS

Knowing what a sequence of operations is — and asking for it — can save time, money, and headaches in any lighting controls project. It can serve as a contract document defining specific set points and criteria for when the installation and setup are considered complete.

Lighting controls save energy, improve occupant comfort, and help meet code requirements. However, without a clear plan, these systems can fall short of expectations. Poorly implemented controls can frustrate owners and occupants, miss eligibility for utility incentives, and even result in failed inspections that delay project completion.

A well-written sequence of operations:

- Impacts how much energy will be saved
- Reduces costly rework and change orders
- Ensures the delivered system matches expectations
- Simplifies system commissioning and troubleshooting
- Provides an operational guide for facilities staff and occupants to explain what to expect from the lighting system and identify maintenance needs

WHEN SHOULD IT BE DEVELOPED?

Timing is everything! It will vary by project type, but in general it should be developed prior to quotation of the system, i.e., submittals or construction documentation for new construction and equipment installations for retrofits.

WHO SHOULD BE INVOLVED?

While different people have a role in creating, reviewing, or using the sequence of operations, there's no single party responsible for its creation. It can vary from project to project, so it's important to clearly define who is responsible from the start and ensure all parties are aware it exists. Common roles include:

- **Building Owners & Facility Managers**
  Define goals and approve final system requirements
- **Electrical Contractors and Installers**
  Assist in defining wiring and programming
- **Control Vendors**
  Provide product-specific capabilities guidance
- **Lighting Designers**
  Design the lighting control system
- **Commissioning Agents & Inspectors**
  Verify that systems operate as documented

WHO SHOULD BE INVOLVED?

With the sequence of operations prepared, electrical contractors, general contractors, systems integrators, startup technicians, field support personnel, and facility maintenance teams can all profit from its use.

WHAT DOES A SEQUENCE OF OPERATIONS LOOK LIKE?

A lighting control system sequence of operations will vary based on the system, the type of space, and the intended control strategies and devices. These may include occupancy sensing, daylight harvesting, scheduling, manual control, trim adjustments, demand response, and other functions. In general, a sequence of operations consists of short written descriptions for each space, tables outlining conditions and corresponding lighting responses, and diagrams or flowcharts illustrating control logic.

The following is an example of a simplified sequence of operations for an open office area.

- Lighting dims continuously in response to occupancy and daylight sensors.
- Lighting is programmed through a time clock to account for weekday, weekend, and holiday schedules.
- Lighting is capable of manual override using wall stations.

Settings include:

MON-FRI 7AM-7PM:

All lighting automatically adjusts to **50%** of maximum output **when occupancy is detected.**

Lights dim in response to sufficient daylight to maintain appropriate lighting levels throughout workspaces.

After **10 minutes of vacancy,** lights dim to **10%.**

After an additional **5 minutes of vacancy,** lights turn off.

MON-FRI 7PM-7AM, SAT-SUN 24 HOURS, ALL PUBLIC HOLIDAYS:

Dedicated lights turn on to **25% when occupancy is detected**

Lights turn off after **5 minutes of vacancy.**

DURING ALL TIMES:

Button 1: All lights 100%

Button 2: Left half of room lights off

Button 3: Right half of room lights off

Button 4: All lights off

Button 5: Ramp up all lights

Button 6: Ramp down all lights

UPON LOSS OF POWER AND FIRE ALARM:

Emergency lights turn on to 100% upon loss of normal power and when the fire alarm system is activated.

HOW TO PROCEED

- **Ask for a sequence of operations early.** The earlier it's documented, the fewer surprises there will be during installation or inspections.
- **Review carefully.** Make sure it matches the building's needs and operations.
- **Keep it on file.** It may be needed for future troubleshooting, maintenance, or renovations.
- **Use it for training.** New staff will appreciate knowing how systems should behave.
- **Additional resources** about the process of writing and utilizing a sequence of operation are available online from many reliable industry associations.

To learn more, email info@mnLLLC.org or visit www.mnLLLC.org.

LLLC Initiative is a statewide program under Minnesota's Efficient Technology Accelerator, a partnership funded by the state's investor-owned utilities, administered by the Minnesota Department of Commerce, Division of Energy Resources, and implemented by Center for Energy and Environment.