Next-Gen Digital Dimming and the Shortcomings of 0–10V

The biggest problem with 0–10V dimming is that the standard isn't entirely standardized. Adjusting the 0–10V signal will not necessarily result in uniform dimming across different LED luminaires. And still, poor compatibility among dimmers and drivers requires changeouts and delays. Running low-voltage control wire to every fixture and component can present high installation costs and hurdles to renovating. Correcting mistakes or reconfiguring requires changeouts and delays.

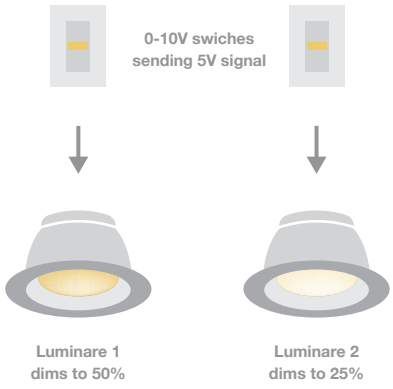
Sure, the 0–10V protocol is widely accepted throughout the industry, and LED drivers often come with a "free" upgrade to 0–10V dimming capability. But because the low-voltage dimming instruction is unidirectional, there is no feedback to signal that the luminaire has, indeed, dimmed – or if the unit is working at all. This lack of feedback prevents the owner from seeing whether the unit is providing proper light levels and energy savings as expected.

Look to the new generation of digital dimming protocols – such as Bluetooth mesh or advanced DALI – for a standardized, linear dimming curve, plus two-way communications to verify the luminaire is operating as expected. Consensus standards bring competitive pricing from a variety of vendors and service providers. Reduced installation costs and software-based rezoning and reprogramming can mean a lack of surprises during installation and renovations. New features, superior value propositions, and the flexibility to add capacity and capabilities make this new generation of digital dimming the future-proof solution.

Watch out

A change to the 0–10V dimming signal can mean different things to different LED drivers, because they use different dimming curves. Depending on the driver and luminaire manufacturers, a 5V signal could result in the unit dimming to 50% of initial output – or it could mean 30%, or 80%. There is no defined standard. In addition, some drivers will, at 0V, dim to off. Other drivers in the same space may dim to 10% or 1% at 0V, and require a separate relay to turn off. Long runs of control wire may also produce unexpected results from the same analog controller, due to voltage drop in the control signal.

0-10V dimming can create inconsistent results



The costs of low-voltage wire and its installation can be prohibitive. A control wire must connect to each and every driver in its zone. Conventional lighting panels, occupancy sensors, timeclocks, and photocells must then be adjusted manually. A complex system could have hundreds of wires, in addition to line voltage. And then, even a carefully designed system can be mis-wired or run up costs for late change orders. Post-occupancy, a simple change in the layout or use of a space may require rewiring – tearing up walls, invading ceilings, and disrupting business operations.

Some 0–10V LED drivers do not meet NEMA 410 requirements for inrush current protection. Multiple fixtures on a single power and control circuit could create such demand that they damage the relay or trip the breaker. For the driver to perceive the correct voltage differential, low-voltage wiring must maintain polarity, another opening for errors. And mistakenly switching line- and low-voltage can cause catastrophic failure in some drivers. (It's likely the entire fixture will need to be replaced, and it's unlikely to be covered by warranty.)

Finally, a given 0–10V dimmer may not operate properly with a given LED driver. If the luminaire flickers or fails to dim, the dimmer or driver must be changed out. When using a variety of drivers and LED lamps, lights may pop on full or drop out completely while dimming; flicker or strobe; or randomly turn on and off. The technology has improved, but there is still not universal compatibility.

Digital can be simpler

In digital dimming systems like DALI, Bluetooth mesh, Zigbee, etc., components are addressed and configured via software, sometimes automatically. The drivers contain intelligence, so they can be easily grouped, programmed, then regrouped and reprogrammed to accommodate changes and correct errors – without rewiring or disruption of business activities. Complex zoning – i.e., including luminaires in widely separated or multiple, overlapping zones – can improve functionality, energy savings, and security.

For digital control systems, polarity is not an issue and wiring patterns are flexible. The wireless systems, preferred for retrofits, save even more in costs for wire and installation labor. Positioning of sensors and panels is far more flexible, and these systems are easily scalable. A wireless survey conducted before deployment can reduce risk of unexpected communication failures, with mesh techniques further improving wireless reliability.

But most important, two-way communications provide information that the unit has, in fact, dimmed. Feedback on the current status and health of each switch, sensor, and luminaire facilitates diagnostics while errors and failures are occurring. For luminaires, timeclocks, dimmer panels, sensors – all the components of the system – prompt maintenance or a quick adjustment via the online dashboard can avoid a costly callback.

Advantages of digital dimming

- Two-way communication with device allows status monitoring
- Software controls for simple configuration and maintenance
- Wireless options for easier installation and scalability
- Open standards for vendor interoperability
- Integration with building management systems
- Data backbone for IoT

The previous generation of digital lighting control systems offered many of these advantages: two-way communication, software-based configuration, and wireless options. But proprietary protocols required that components and services be sourced from a single vendor. Proprietary systems often were limited in programming options and expandability. And in larger systems, an expensive service contract was necessary.

Today's emerging, internationally published interoperable open standards can offer compatibility among sensors, drivers, and controls from an array of vendors – connect it and forget it – which makes specification easier. Products will work together initially, and adding or replacing components in the future will be seamless. Dimming is defined as a percentage of initial output, regardless of manufacturer, fixture type, or driver. Turn-on and dimming performance are predictable and consistent.

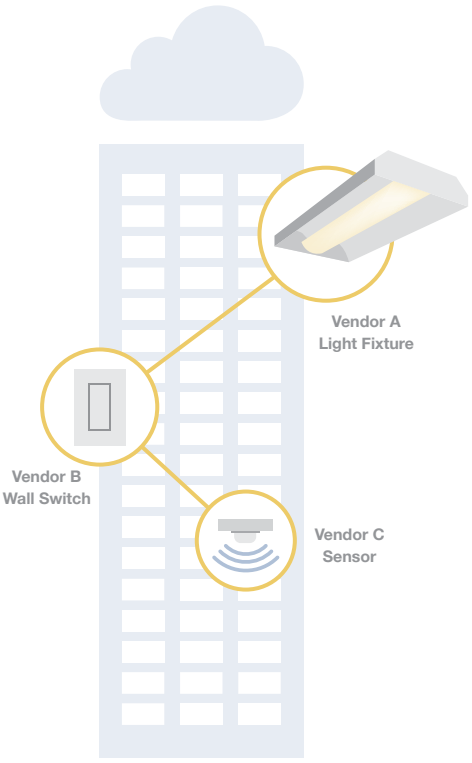
When end-users choose products created using protocols based on interoperable, open standards, they are no longer locked-in to a specific vendor for capabilities, components, and services. Interoperability comes with competitive pricing and a broad offering of features, benefits, and value propositions.

Digital dimming systems can also integrate with building-management systems, where sensor data can be used to cue HVAC controls, an avenue for substantial savings. Demand-side management and other energy- and cost-savings schemes use dimming and switching off to lighten electrical loads. Top-end trim, sequencing, highly selective zoning, and other creative schemes can introduce value propositions pre- and post-installation.

The most advanced systems use the lighting infrastructure as a data backbone, transmitting information and instructions to and from various kinds of beacons and sensors to enable wayfinding, tracking, safety and security, or quality control – even smartphone control of environmental conditions or other processes.

Open standards mean predictability in performance, competitive pricing, and a lack of surprises during installation and renovations. And as these systems are deployed and repurposed, look forward to new, creative energy-savings schemes and value propositions we haven't even thought of yet.

Open standards allow use of multiple vendors



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