

Retrofit Fluorescent Dimming with Integrated Lighting Controls

Historical Perspective

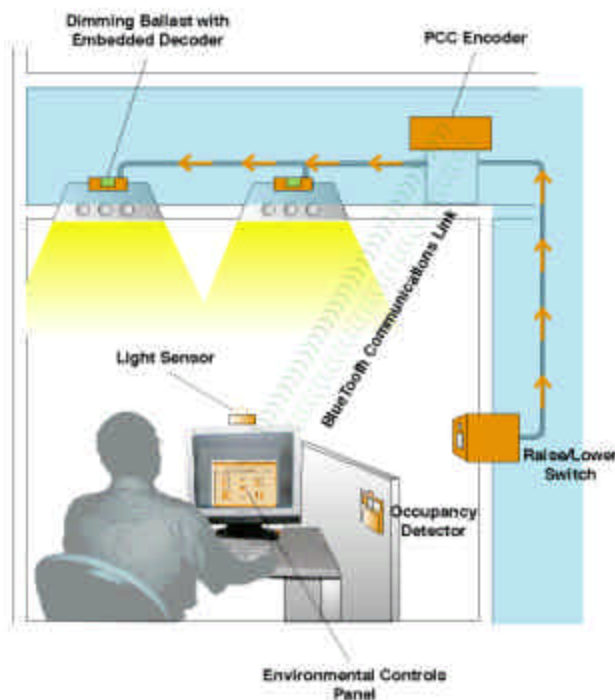
Lighting control systems that exploit control strategies, such as daylighting, personal controls, and load shedding, have enormous potential for reducing lighting energy consumption in commercial buildings, enhancing occupant comfort, and improving organizational efficiency. However, even with new advances in digital lighting technology, such as the DALI protocol, the benefits of integrated lighting controls are slowly being realized only in newly constructed buildings.

The huge untapped reservoir of energy savings lies not in new buildings but in the 70 billion square feet of *existing* commercial building floor space. Until now, installing advanced lighting controls into existing buildings required adding control wiring, which is cost-prohibitive because of installation labor costs. The answer to moving integrated lighting controls into existing buildings is a lighting control solution that does not require additional control wiring.

An Integrated Solution

To tackle this formidable problem, LBNL researchers have collaborated with Vistron to create a proof-of-concept dimmable lighting control system that does not require additional control wiring in the ceiling. The system uses a new power line control communication technology, called Phase Cut Carrier, to send digital commands over existing lighting power circuits.

According to Francis Rubinstein, the LBNL researcher who co-invented the system with Pete Pettler, of Vistron, "With Phase Cut Carrier, we can reliably send control signals from a junction box-mounted *encoder* downstream to dimming ballasts embedded with *decoders*. This lets us control and dim all the ballasts on a lighting switchleg without having to add wires into the ceiling."



As shown in the graphic, in addition to replacing the existing ballasts with dimming ballasts equipped with embedded decoders, the Berkeley Lab system requires installing a PCC encoder to each switch zone to be controlled.

Eventually, ballast manufacturers will embed the decoder directly into their dimmable ballasts making the retrofit even easier and less expensive.

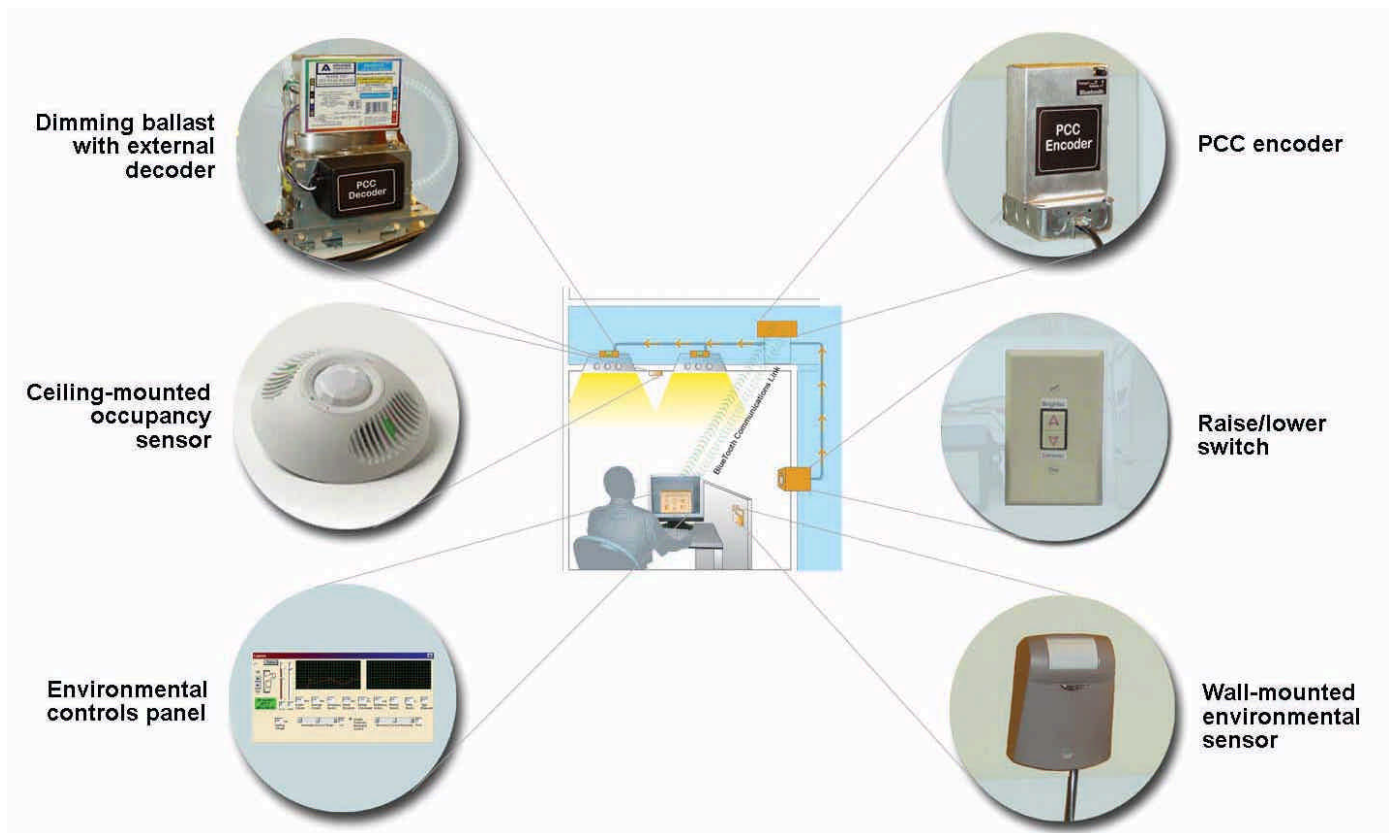
Occupants can easily and quickly control lighting levels from their desktop.

Advantages:

- Less expensive to install into existing buildings than conventional dimming.
- Enables lighting system to respond to available daylight and demand response control.
- Allows building occupants to dim their local lighting systems.
- Allows organizations to set overhead light levels according to workgroup preferences.
- Won't compromise the electrical distribution system by adding undesirable current harmonics.
- Favorable signal-to-noise ratio compared to conventional Power Line Carrier (PLC) techniques.
- Eliminates the possibility of interfering with other upstream building equipment.

System Diagram:

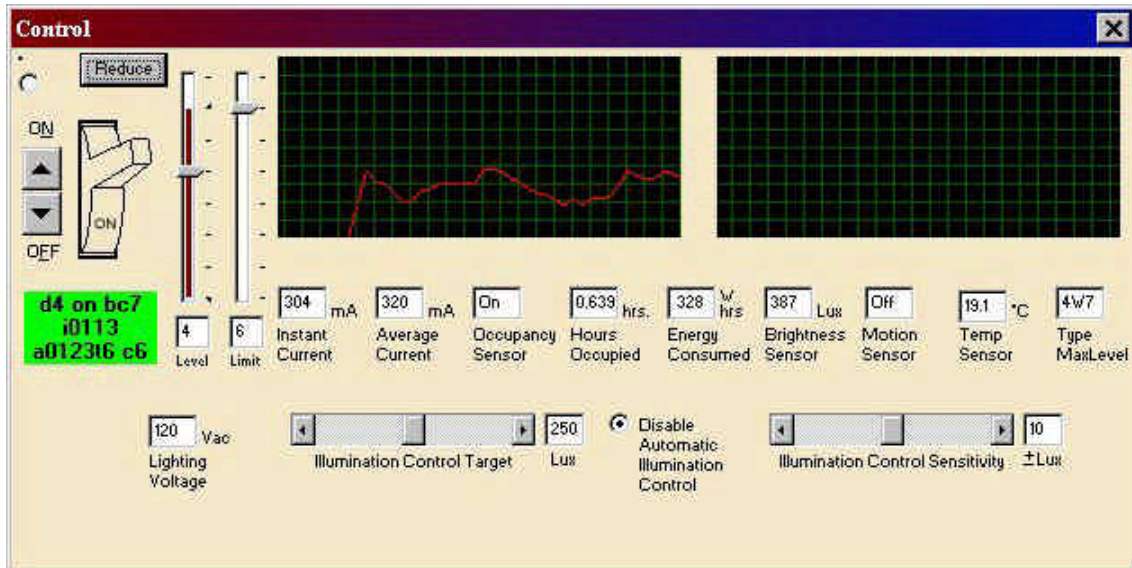
The below diagram shows the various components of the integrated lighting control system.



The control panel (see graphic on page 3) for the desktop demonstration system shows the rich set of controls and annunciators built into the control software. From this control panel, the user can monitor and control all aspects of system operation and even log the workplane illuminance and power consumed by the overhead lighting system.

Economics

Berkeley Lab researchers estimate that the system would cost about a dollar per square foot to install in existing buildings (labor and parts included), and could result in energy savings of 20 to 25 cents per square foot per year (five year simple payback).



Status

A desktop demonstration system has been completed and is currently undergoing evaluation and testing. Controls, ballast, and sensor manufacturers are also being courted to move the proof-of-concept system towards prototype development.

LBNL has filed a provisional patent on Phase Cut Carrier (PCC) technology filed. The PCC technology is available for licensing or collaborative research.

Acknowledgements

The California Energy Commission Public Interest Research (PIER) Program under the Lighting Research Program provided support and funding for this work. For more information on the Lighting Research Program, visit www.archenergy.com/lrp

Portions of this was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technology, Building Technologies Program, of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

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