



## **PIER Lighting Research Program**



**California Energy Commission  
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# **Control Needs Definition and Applications Research Summary Reports**

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# Control Needs Definition and Applications Research Summary Reports

## Introduction

The DALI is a non-proprietary digital communication protocol that allows communications between a DALI ballast and the lighting system. Tridonics, Advance Transformer, and OSRAM SYLVANIA currently offer DALI ballasts. The key features of the DALI ballast enable:

- Two-way communications for obtaining operating status and performance of luminaires.
- Individual fixture control which allows users to re-configure space lighting groups without changing the wiring, easily implement load-shedding functions, and integrate a fixture into multiple control zones.
- The user to mix and match ballasts from multiple suppliers and obtain consistent control operation.
- The elimination of costly installation errors due to reversing control wiring at ballast or control terminals.
- The easy addition of DALI-based wall controls and other devices because a two-wire communications bus is used. This feature greatly reduces labor and installation costs.

The goal of Project 5.4 DALI Lighting Control Device Standard Development is to develop an enhanced DALI lighting ballast control standard to allow for the operation and control of a complete lighting system. The enhanced DALI open standard would enable different manufacturers control devices to operate on the same control system.

To realize this goal, industry consensus must be reached among the different control manufacturers. The standard would create predefined messages and commands that would be embedded in the controller intelligence and allow for seamless communication between control devices and between the control device and the ballast.

## Task 1 Objectives

Task 1 involves defining the customer needs for automatic control, manual overrides, central monitoring and reporting, load shedding, occupancy control, and daylighting for commercial offices and school applications. Differences in the needs of small and large buildings and their impact on the application of DALI controls are included. Additionally, customer needs for small and large commercial and institutional markets have been assessed.

Completing Task 1 helps to achieve the project objectives by establishing the baseline functional needs for the control standard based upon an understanding of end user and applications needs.

A Power Point presentation has been prepared encompassing detailed information for the below deliverables and is provided separately from this Word document.

- Control Needs Definition Summary
- Applications Research Summary

### **Task 1 Executive Summary**

While the Power Point presentation provides the comprehensive data about the control needs definition and the applications research, the executive summary from the presentation is provided below to orient the reader to the activities.

The goal of Project 5.4 is to accelerate the use of fluorescent dimming in office and school applications, thereby reducing lighting consumption and demand. The development of a DALI controls protocol is a supporting strategy intended to assure the owner and specifier that the control devices and ballasts will function as a system, even when using parts from different manufacturers.

The “Control Needs Assessment” is focused on the following questions:

- What is currently being done?
- How satisfied are customers with the current solutions?
- How receptive are they to control strategies that rely heavily on dimming?
- How important is a control’s protocol to customers?
- What features/benefits of DALI should be accentuated in a standards development?

The first four questions were addressed in The Watt Stopper funded study by Ducker Research. The pertinent results are being shared in the Power Point presentation with the California Energy Commission Pier Program to support the growth of the industry.

The research used telephone interviews of 158 facility managers, electrical engineers and architects. To summarize, this study concluded the following:

- Approximately 65 percent of new office and school construction uses automated lighting controls.
- Occupancy sensing and scheduling dominate.
- The customers view these controls as effective and relatively problem-free.
- Their major drivers for using controls were energy savings and energy code compliance.
- Demand shedding based on a signal from the utility and daylight harvesting, two strategies that are commonly associated with dimming, were not viewed as important. However, low cost dimming was ranked as the technology advance that would have the greatest impact on lighting control application.

- Industry standard protocols were ranked just below low cost dimming.

The fifth question was addressed in a survey of NEMA manufacturers involved in the development of DALI products and services. The ability to “tune” the lighting to the actual space usage or occupant preference was ranked as the most important feature. This was believed to impact occupant satisfaction while also reducing energy consumption. Accordingly, a DALI controls protocol should reflect occupant control as a priority. It should be noted that a Light Right study of the impact of lighting quality and control on occupant satisfaction and performance supports this recommendation.

Occupant control was followed by LEED certification and Intelligent Building Operation as the most important value propositions. A preliminary survey of architects confirmed this finding.

### **Applications Fit**

The above analysis provided a high level view of the market needs and interest. To provide more practical guidance in the development of a protocol, we choose to look more closely at individual spaces within the two major target applications: offices and schools. These spaces reflect the experience of Watt Stopper’s application support group coupled with data from the Energy Information Agency and the American School and University. Best practice control solutions using today’s switching technologies were then compared to proposed solutions using digital dimming and addressability. Drawings of the individual space types and the comparison of the control scenarios are in the attached PowerPoint document.

#### Observations:

- DALI can significantly decrease wiring time and complexity for some applications such as conference rooms.
- Individual fixture control will provide the greatest energy savings and occupant satisfaction in open offices. This also raises questions about fixture design and integration with Information Systems.
- Complete solutions will require control of other loads such as window blinds.
- Different fade rates for raise versus lower will prove to be a problem.
- Daylighting and occupant personal control conflict.
- DALI control benefits are application-specific. For example, DALI provides minimal incremental benefit in enclosed office hallways, but major benefit in school hallways.

The recommendation from The Watt Stopper is to expand the discussion on these propositions in a combined focus group/roundtable in two locations (see Next Steps section below). The focus group format provides the opportunity to explore differing viewpoints and test the conclusions that have been reached.

## Next Steps

The next step for Project 5.4 is to define and analyze the strengths and limitations of DALI, and opportunities for including the standard control command structure within the DALI universe resulting in a technology assessment report (Task 2). Task 3 involves developing a white paper that summarizes what was learned in Tasks 1 and 2. The white paper will be used as the basis for discussion at the first industry roundtable (Task 4) that is planned for June.

In addition to the roundtable (Task 4), two focus groups are planned to ensure information is gathered from a broad base of end-users. Spectrum Associates will conduct the focus groups with a mix of designers (i.e., architects, consulting engineers, lighting designers) and end-customers (e.g., office building owners and developers). One each in San Francisco and Los Angeles is planned. The Watt Stopper will arrange to have manufacturers who are participating in the California Energy Commission DALI research effort observe the San Francisco and Los Angeles designer/end-customer focus groups, and Spectrum Associates will conduct focus groups with the manufacturers immediately following the designer/end-customer focus group. During the manufacturers' focus groups, participants will identify the key insights obtained from the designer/end-customer focus group, and brainstorm strategies for applying this information in marketing DALI, addressing barriers to purchase and standard development.

The customer input information is vital to helping manufacturers develop a standard that everyone will find beneficial. The Watt Stopper is confident that the above mentioned tasks are within the budget and timeline of this project.