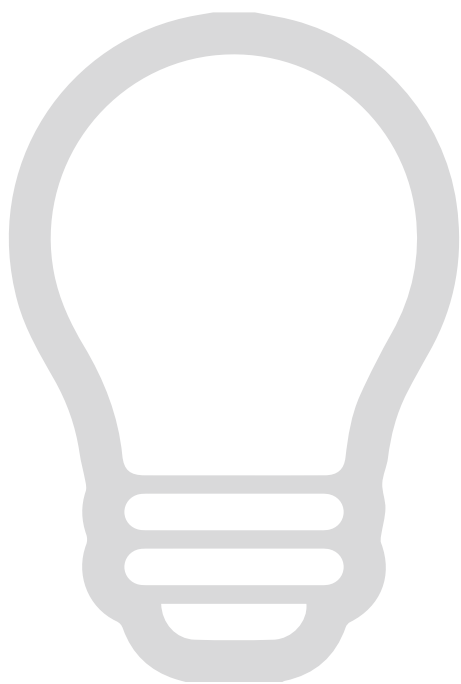# LOYTEC Focus

L-DALI
Lighting Control Solutions

LOYTEC
A Delta Group Company

CONTENT

MASTHEAD

LOYTEC

L-DALI Lighting Control Solutions

Trends and Developments

Intelligent lighting control systems are in great demand. With the technology leap for LED technology, lighting control enjoys even greater popularity. Since LEDs require electronic drivers for operation, costs for the digital operation of these electronic drivers are low.

Whether airport, railway station, office building, or hotel, more buildings are equipped with modern lighting control systems. For the future, it will be that no commercial building is built without digital lighting control.

The reasons for that are simple:

- Intelligent lighting control allows reducing energy consumption 30–60 % in addition to savings from the changeover to LED technology. Because of low additional investment costs in the course of a change, usually investment pays off in less than 2 years.
- Adaptive control algorithms identify the available daylight to ensure ideal lighting conditions and increase the occupant's well-being.
- In addition to energy savings, maintenance effort is considerably reduced, as operating parameters like fault conditions, operating hours, and energy consumption for each individual luminaire can be accessed centrally.
- Synergies are created due to integration with other automation and management systems in the building (e.g. HVAC).

In a discussion about digital lighting control, LOYTEC is referring to DALI, at least when cost efficiency and a future proven investment are a topic. The first LOYTEC DALI controller was introduced in 2006, long before the current trend appeared. With more than 10 years of experience in DALI lighting control and the L-DALI family of products, LOYTEC has a powerful and well- proven solution for this field of application. It allows partners and customers to be part of this evolution and implement state of the art lighting control systems.

Energy Savings

The function "presence detection" optimizes energy usage by ensuring that lights are only on when required. In a fully automatic environment, lights are switched on when the area is occupied and switched off when no occupancy was detected for some time. In a semiautomatic environment, lights can be switched on (and off) manually and are switched off automatically once the area becomes vacant.

Presence information is typically provided by sensors. LOYTEC provides sensors suited for most applications, but also allows seamless integration of sensors by many other vendors, ensuring you can choose the sensors, which suit your application best. Presence information collected in the lighting control system is also provided to the other automation systems in the building (e.g. HVAC, access control and more). On the other hand, information can also be provided by sensors already present in the building or by other sources in the buildings

automation system (e.g. access control). Open and standardized interfaces allow for the integration of a large number of sources.

In office spaces, even the PC activity of the occupants can be used to determine the occupancy state of the room: If the L-WEB client installed on the PCs detects inactivity, it reports this information to the building system. Similar to the PC monitor entering standby, the lights in the room are switched off.

Benefits:
- **Increased well-being, as the lights are switched on automatically whenever a person enters the room or area**
- **Energy savings due to lights being automatically switched off in unoccupied areas**
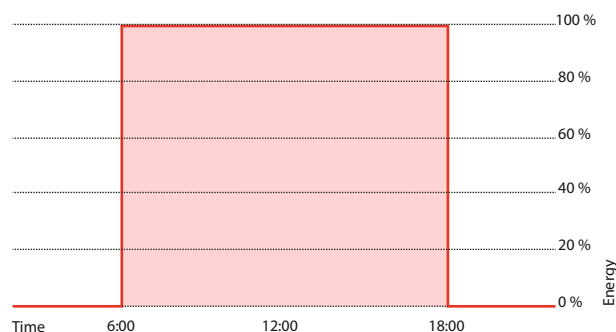
Energy consumption without presence detection
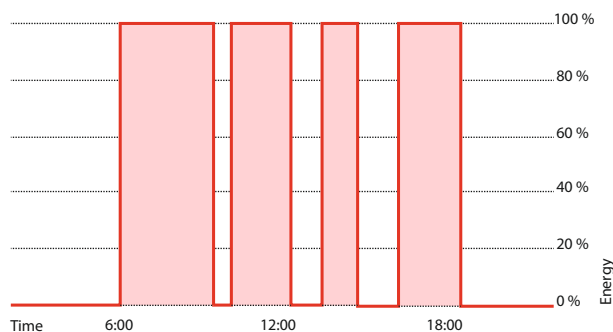
Energy consumption with presence detection

Using Daylight

Daylight harvesting – also referred to as constant light control – is a control strategy, which controls the artificial light depending on the available natural light, ensuring that the output level of the lamps is not higher than required to maintain the desired light level. This control strategy not only decreases energy usage significantly but also increases the comfort and well-being of the room's occupants. Changes alternating from natural to artificial light are unnoticed to an occupant as the desired lighting level is ensured.

Optimum energy savings are achieved when combining daylight harvesting with presence control. Energy savings in such a scenario are typically between 40 % and 60 %. LOYTEC's and most other vendor's sensors provide presence and lux level information that allow implementing this functionality without any additional cost.

Due to open and standardized interfaces sun blinds can be easily integrated in this control strategy, ensuring perfect interaction of the two control strategies and

Energy consumption using daylight harvesting
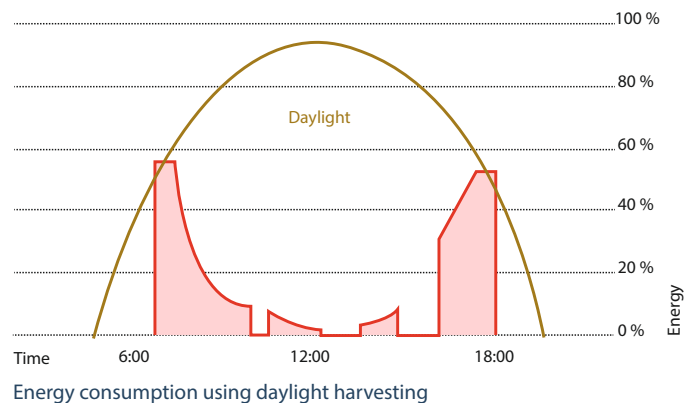
thus increased user satisfaction with the automation system. Especially for applications where a specific light level should not be exceeded (e.g. in museums or conference rooms during presentations) the connection of lighting and sunblinds control is a must.

Benefits:
- **Increased comfort due to automatic and smooth transition from natural to artificial lighting**
- **Energy savings due to the reduction of artificial lighting when sufficient daylight is available**

Manual Control

Even when automatic lighting control is intended, the user must be provided with an option to manually override the system locally. Studies on user acceptance of building automation functions reveal that the possibility to override automation functions, even if hardly used, substantially contributes to user satisfaction.

Moreover, it must be possible to choose the desired lighting scenario in rooms with different usage scenarios (e.g. conference rooms, lecture halls, restaurants and more).

In addition to operating lights through conventional push-buttons via LDALI-BM2 and a wide variety of different L-VIS Touch Panels, the L-DALI system can also be operated via the web-based HTML5 user interface LWEB-802 from any standard web-browser, tablet, or smartphone.

Together with an automatic mode, such a web-based, virtual room control unit provides a cost effective alternative to mechanical switches and touch panels: The basic functionality is covered by the automatic mode, while manual user interventions are possible via office PC, tablet, or smartphone. In such a scenario, it might even be possible to completely eliminate mechanical switches and touch panels, leading to substantial cost reductions. For smaller projects, the L-WEB application can be hosted directly on the L-DALI controller, whereas a central hosting (e.g. LWEB-900) is recommended for larger projects.

Benefits:
- **Traditional control using push-buttons and switches**
- **Cost-effective web-based virtual room control units via PC, tablet, or smartphone**
- **Wide range of touch panels**

Tablet, PC, Smartphone (LWEB-802/803)

Conventional switches

L-VIS Touch Panel

Remote control

LWEB-900 BMS Visualization

Human Centric Lighting

Luminaires with tunable white functionality become more and more common. Tunable white luminaires allow changing the color temperature between warmer and cooler light dynamically.

By automatically adjusting the color temperature of the artificial light over the course of a day, the natural change of the sunlight can be simulated – warmer light in the mornings and evenings, cooler light at noon, with unnoticed changes in between. Studies show that this biorhythm-friendly control strategy not only increases occupant's subjective wellbeing, but also their productivity and accuracy. Due to the support for the human's Circadian rhythm, it is often referred to as Circadian lighting.

In hotel rooms, manual adjustment allows occupants to choose between warmer and cooler light depending on their individual preference or mood, in shops and supermarkets, the right color temperature is key when it comes to effectively presenting goods.
LOYTEC's lighting control solution allows for both automatic and comfortable manual adjustment of color temperature. Of course, any tunable white functionality can be combined with the other control strategies (occupancy based, constant light control and others) supported to provide human centric lighting at its best.

Benefits:
- Increased wellbeing and productivity by supporting the human's Circadian rhythm
- Cater to the occupants individual preferences and moods
- Provide perfect setting for presentation of goods, art and others

IoT Integration

Actually any modern device provides an IoT interface. Multimedia projectors, A/V systems or Smart-TVs - LOYTEC's groundbreaking JavaScript based IoT integration functionality allows to integrate them all. In short: If you can control it via app, you can integrate it into the lighting control system.

Typical applications are meeting rooms or auditoriums, where scene control not only controls the room's lights and shading, but also drives screens and switches on the room's multi-media equipment by the touch of a single button. Similar products from the consumer sector like a Sonos® audio system, Philips Hue lights or Alexa and friends can be connected to the LOYTEC lighting system.

The IoT integration functionality allows to connect the system with almost any cloud service, either for uploading performance data for further processing or for using information from the cloud in the lighting control application (e.g. scheduling based on web-calendars or booking systems).

Benefits:
- Easy integration of multi-media equipment with lighting control system
- Connect consumer products like Sonos®, Philips Hue, Alexa and friends
- Uploading data to cloud services for further processing
- Scheduling based on web-applications (e. g. Google Calendar)

Emergency Lighting

Self-contained or centrally powered emergency lights, dedicated emergency luminaires, or normal office luminaires with added emergency functionality, all these types of emergency lighting can be easily integrated in a LOYTEC lighting system. This not only allows to use the same wiring for emergency lighting as for conventional lighting, reducing installation cost, but also to integrate the necessary supervisory and monitoring functions into one management system. This results in further cost savings and offers the facility manager a single operating interface for all functions of the building. As an additional benefit, function tests of the emergency system required by law can be automatically executed and results can be logged.

In addition to the integration of emergency lighting, the lighting system can also be connected with the fire alarms system. In case of an emergency situation the lighting system is notified and can support the evacuation of the building by increasing light levels in the designated escape routes.

Benefits:
- **Cost savings by automating the periodic testing required in case of emergency lights**
- **Ease of maintenance and monitoring by providing a common user interface**
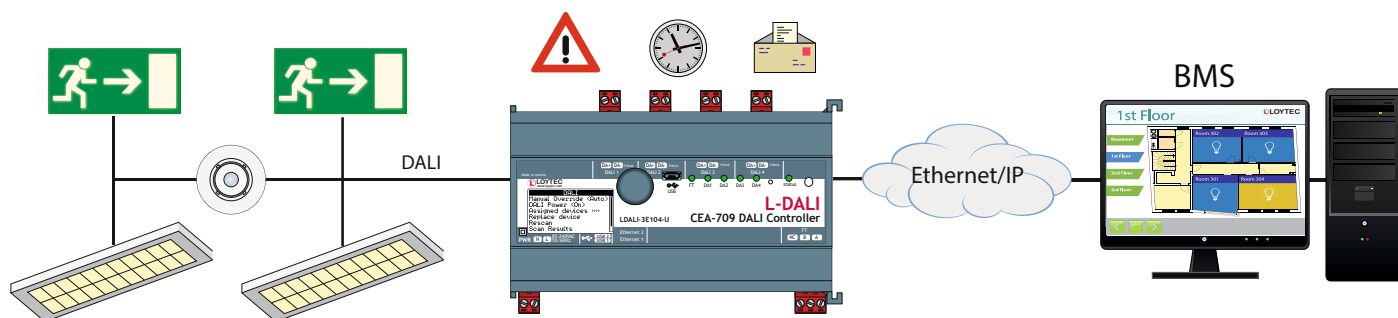
Maintenance and Monitoring
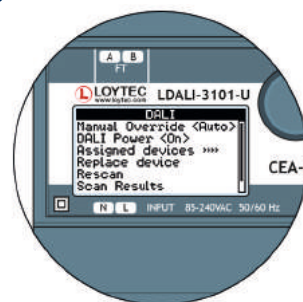
Only powerful visualization, reporting, maintenance, and alarm features ensure the smooth operation of the lighting system. As the L-DALI system supports open communication standards, it can be easily integrated into any building management system on the market. With LWEB-900, LOYTEC provides a scalable, server based, multi-user capable and fully developed building management software. The software can either be installed on a separate server or rented as a service.

Using its powerful visualization features, the status of the lighting system can be displayed and parameters or control strategies and schedulers can be altered comfortably. It is important to consider changes in the room usage or to optimize the system in terms of energy consumption and user comfort. Alarms reported by the system can either be displayed in the front end of the building management system or sent via e-mail. Any system data can be stored in historical trend logs for subsequent analysis and reporting.

Special features, such as reports on the status of the system and the connected DALI luminaires and monitoring luminaire operating hours, allow to ideally plan main-

tenance cycles. With the help of powerful reporting functions, the collected data is presented in the form of energy consumption reports, room usage statistics, or maintenance lists. Efficient backup and restore functions at all levels – whether L-DALI controller or DALI luminaire – ensure a high availability of the system. As soon as a broken part is replaced, device configuration can easily be restored using the last known backup. Hence, these tasks can be accomplished by in-house technicians minimizing maintenance costs.

Benefits:
- Open and standardized interfaces allow integrating wide range of management systems
- Flexible configuration of schedulers (centralized/decentralized)
- Maintenance can be done by in-house technician
- Automatic generation of maintenance lists for in-house technician
- Reporting feature for energy consumption and operating hours
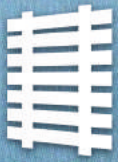
Using Synergies

While other manufacturers traditionally rely on closed, stand-alone solutions, the LOYTEC lighting system provides all communication interfaces common in building automation systems. All values and parameters can be accessed via open and standardized protocols like BACnet, LonMark, Modbus, OPC, and web services. This opens up numerous possibilities:

- Common user interfaces: Whether lights, air-conditioning, sunblinds, or multimedia equipment, all functions in a room can be operated via uniform and consistent user interfaces. A consistent look & feel allows for intuitive operation and increased user satisfaction and acceptance.
- One management system for all systems and functions: Regardless of whether you choose LOYTEC's L-WEB system or another management system solution, all functions and systems in a building can be integrated in a single visualization solution. This not only results in a better system view for the building manager, but also leads to a significant reduction of initial purchasing, training, and maintenance costs.

- Shared resources: Presence sensors, touch panels, I/O modules, and software licenses can be shared among the different systems in the building. Sensor information like presence status provided by the LDALI-MS2 can be made available to different other parts of the automation system (e.g. HVAC, access control). On the other hand, this information can also be provided by other sensors or other sources in the building automation system (e.g. access control). Similarly, push-buttons connected to the LDALI-BM2 can be used to control other subsystems (e.g. sunblinds) or push-buttons connected to I/O modules (BACnet, LonMark) can be integrated in the lighting application.

Benefits:
- **Consistent user interfaces for all building functions**
- **Reduction of initial and maintenance costs through the joint usage of resources (sensors, user interfaces, management system)**

DALI Quick-Facts

- DALI is a manufacturer-independent standard for digital lighting control standardized by the international-al standard IEC 62386. All large and a growing number of small manufacturers support this standard and provide an ever growing portfolio of DALI devices.

- DALI stands for simple cabling and high reliability. Only two additional wires are necessary in addition to the three wires required for mains supply. Up to 300 m cable length with free topology are permitted. Connection to the ballasts is polarity insensitive.

- While DALI-1 only applies to ballasts & luminaires, DALI-2 also covers sensors and buttons (input devices).

- DALI supports up to 64 ballasts/luminaires and 64 input devices (sensors, buttons and more) per channel. DALI ballasts can be grouped together. 16 groups are available per channel.

- DALI devices report the device status (e.g. lamps failure).

- Optionally, DALI devices can be powered via the DALI bus. This is typically the case for DALI sensors and buttons.

- DALI-2 devices can be certified by the DALI user organization, the Digital Illumination Interface Association (DiiA). LOYTEC recommends to only use DALI-2 certified devices whenever possible.
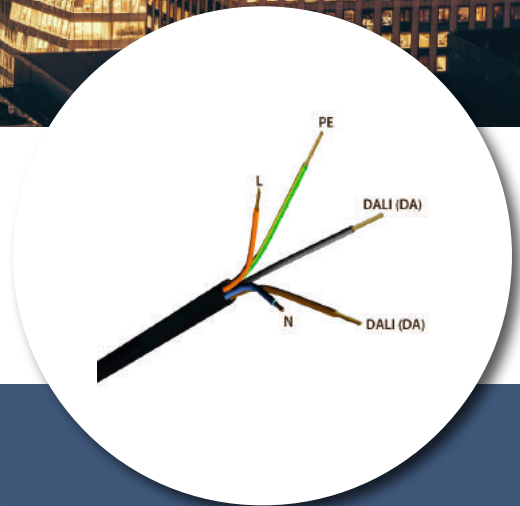
The L-DALI System

L-DALI Controller

The L-DALI controller is the heart of the system. Depending on the model, each L-DALI controls up to 4 DALI channels, this means up to 256 luminaires in total. The built-in DALI bus power supply saves costs and space in the control cabinet. The LCD display together with the jog-dial enables an easy setup: The IP address can be configured and a simple check of the connected DALI channels can be performed directly on the device via this simple user interface. Due to these local operation capabilities, maintenance tasks like the replacement of broken DALI devices that are typically performed by an in-house technician do not require any PC or notebook. The lighting application integrated in the L-DALI controller covers all standard application scenarios like

LWEB-900
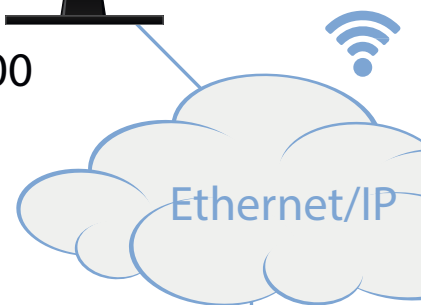
Ethernet/IP

Ether
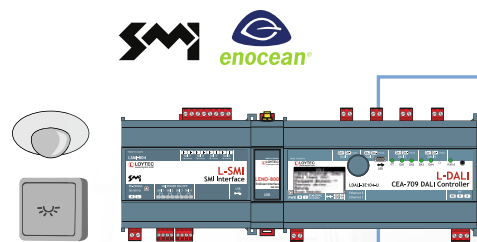
DALI

RM3
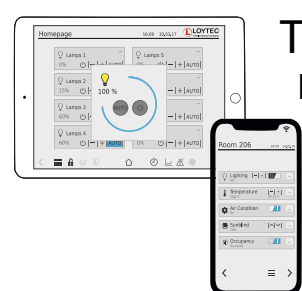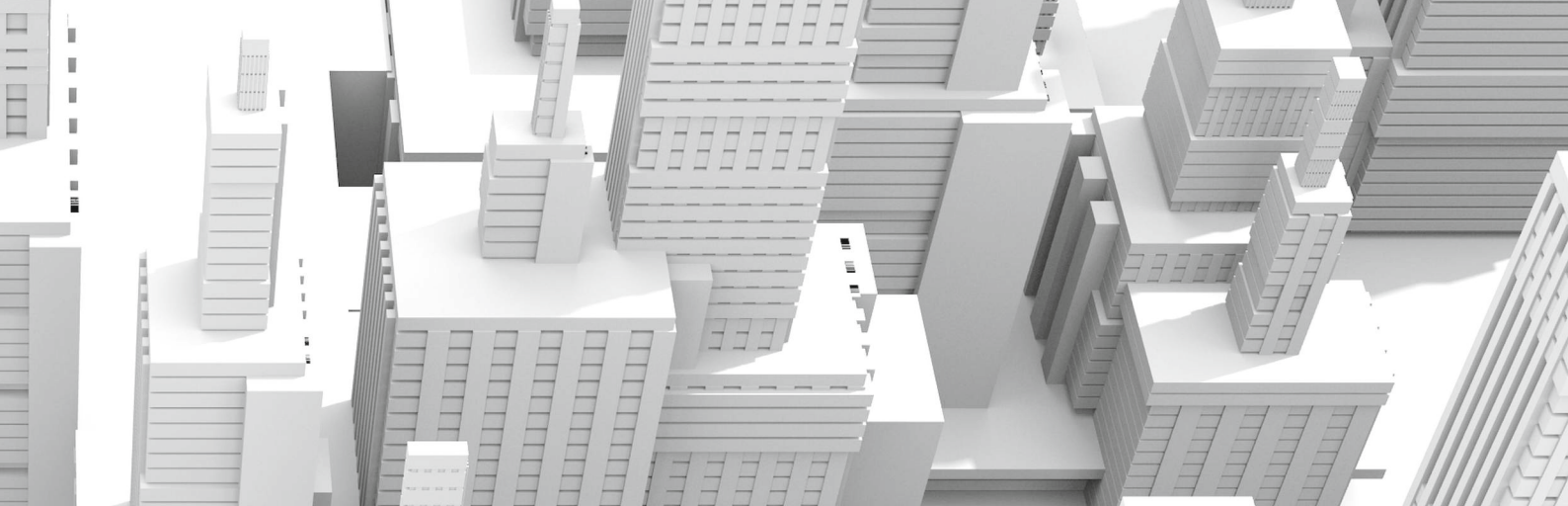
Tablet PC
LWEB-802

Smartphone

L-VIS

net/IP

MS2   BM2
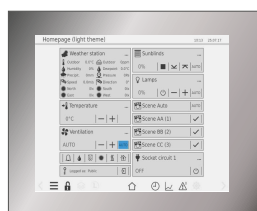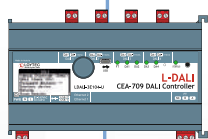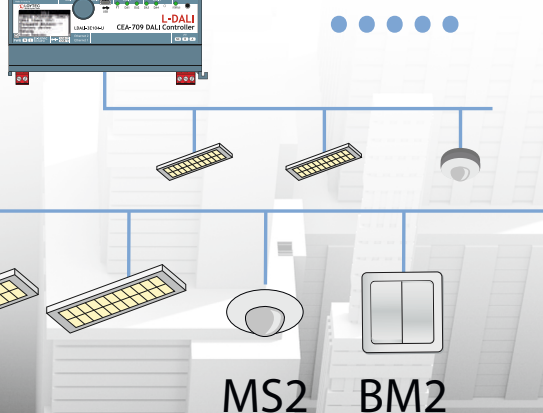
presence-based control, constant light control, corridor light, scheduling and more. Various parameters allow flexible customization to meet different customer requirements. What's more, different control strategies can be combined, for example, depending on the time of the day. For even more flexibility, a programmable version of the controller – the LDALI-PLC4 – is available.

The L-DALI controller is also in charge of monitoring DALI devices. If a device fails or reports an error, e.g. a lamp failure, an alarm is generated and logged. In addition, energy consumption and operating hours are calculated. Of course, popular features of the other LOYTEC controllers such as alarming, historical trending or event-driven e-mails are available, too.

The L-DALI System

LDALI-MS2 Multi-Sensor

Apart from L-DALI controllers, the L-DALI system also includes sensors and actuators necessary for lighting applications. All L-DALI sensors and actuators are connected via the DALI bus with the L-DALI controller. As the devices draw energy from the DALI bus, no additional power supply is required. Hence, cabling is easy and cost-effective.

The LDALI-MS2 multi-sensor delivers lux and presence information that is necessary for constant light control or presence-based control. With a maximum installation height of 5 m and a typical coverage of 90 m^2 (installation height: 3 m), the LDALI-MS2 is an extremely cost-effective solution for most application scenarios. Alternatively, if special requirements have to be met (e.g. a high bay installation in a warehouse) or if specified by the customer for some other reasons, DALI sensors from a wide range of manufactures (OSRAM, Philips, ThebenHTS, Tridonic, Steinel and more) can be used.

LDALI-BM2 Push-Button Coupler

With the LDALI-BM2 push-button coupler, conventional push-buttons and switches are integrated into the DALI system in a simple and cost-effective way. Per LDALI-BM2, four inputs are available. The actions triggered upon buttons being pressed can be configured flexibly (dimming, scene recall, changing color temperature, sunblind control and more). Buttons can also be used to manually override any automatic operation.

Expansion Modules

Expansion modules provide additional functionality. The LSMI-804 module allows controlling sunblinds on up to 4 SMI channels, so up to 64 motors in total. The integrated sunblind controller application interacts with the DALI lighting control leading to additional energy savings along with increased user comfort. With the LENO-80x module wireless EnOcean sensors and switches can be integrated into the L-DALI system, wherever needed (e.g. retrofit or modern offices with glass walls).

LDALI-RM3 Relay Module

The LDAL-RM3 relay module allows the integration of non-DALI luminaires or other loads that are controlled by the L-DALI controller together with lighting. Typical application scenarios are fans in toilets or washrooms and motors for partition walls or screens that should be moved up or down based on a scene selected. Its 1-10V interface even allows controlling legacy dimmable ballasts.

L-VIS Touch Panel

L-VIS touch panels are ideal for visualization and operation of lighting and other functions of a room or an area. The fully customizable user interface can show dynamic pages that are easy to navigate. L-VIS impresses with its timeless design, the harmonic integration into modern and historical architecture, and with it's extremely user friendly operating concept.

The shallow installation depth and low thermal power loss allow mounting in almost any location. Different models from 7" to 15" are available. This allows choosing the size of the screen depending on application requirements, available space, and budget.

As the touch panels support all standard functions of a management system, like alarming, scheduling, and trending, they can also be used in smaller projects for plant visualization and monitoring instead of a PC based solution, reducing initial and maintenance costs.

LWEB-802/803 Web Operation

LWEB-802 serves to operate a room via a standard web browser. By utilizing HTML5 and Java Script, the pages are displayed in a standard web browser without the need to install any additional software or browser plug-ins. This allows using LWEB-802 projects also on smart phones and tablets running Android OS or iOS, eliminating the need to install and maintain apps.

When designing user interfaces based on LWEB-802, the designer faces practically no limits regarding the size, colors, and utilization of graphical elements. Thus, the interface can be flexibly adjusted to customer requirements. Especially when using automation functions – whether lighting control or fully integrated room automation – LWEB-802 provides an alternative to traditional room operating units: Basic features are covered via automatic mode, manual user interventions are possible via PC, tablet, or smartphone.

LWEB-803 allows operating LWEB-802 interfaces on Microsoft Windows PCs (as an alternative to standard web browsers). A "design view" mode allows designing "widgets" without frames and with transparent background. In "kiosk mode" the user can only operate the LWEB-803 application. Here, the user has no access to the PC desktop or other installed software applications. Further, LWEB-803 can report the PC activity of the user to the automation system helping the system to determine the occupancy state: If no activity is detected for a specific period of time, not only the monitors will enter standby, but also lights will be switched off automatically.

For smaller projects, the L-WEB operation can be directly hosted on the L-DALI controller, whereas a central hosting including access and user administration (e.g. LWEB-900) is recommended for larger projects.

LWEB-900 Building Management System

The building management software LWEB-900 provides a user interface for operators and facility mangers to manage and operate their building. LWEB-900 is a highly flexible and scalable solution, which accompanies you from installation and configuration of the automation system all the way to daily operation of the facility. Thus, a common user interface for the building automation system is available at all phases of the project.

LWEB-900's range of applications is not only restricted to lighting systems. Due to its open and standardized communication interfaces, other systems – whether realized via LOYTEC components or by another manufacturer – can be integrated. This not only results in a better system view for the building manager, but also leads to a significant reduction of initial purchasing, training, and maintenance costs.

LWEB-900 fulfills a wide range of functions:
- Visualization of the lighting system status
- Central switching
- Change of lighting control parameters (e.g. light level, hold time, control algorithm)
- Hosting and administration of LWEB-802/803 projects including user and right management
- Change of schedules
- Alarm management
- Long-term data recording to optimize energy consumption
- Monitoring of emergency lighting system
- Automatic creation of maintenance lists and other reports (e.g. energy consumption)
- Device configuration
- Firmware update distribution
- Regular system-wide backups of all relevant device configuration data
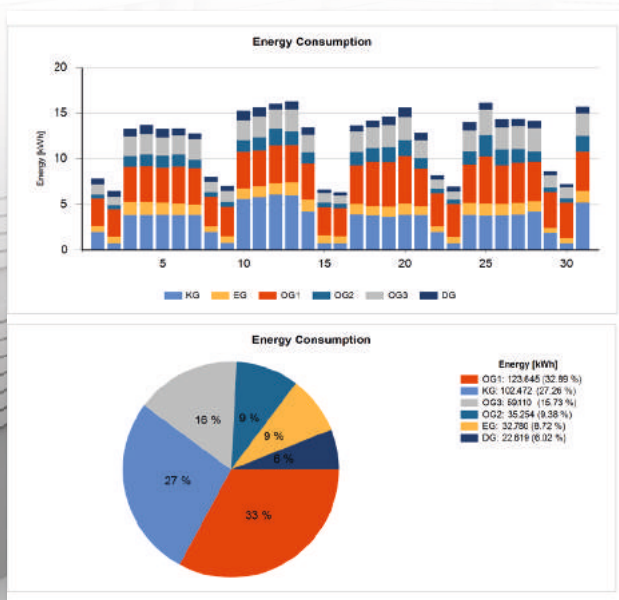
Energy report

LWEB-900 Building Management System

The LWEB-900 Building Management System uses a client-server architecture. One LWEB-900 server can be accessed by one or multiple LWEB-900 clients as user interfaces. As a central component, the LWEB-900 server manages and stores system and operating parameters, historic data, access rights, and device configurations (backup) in an SQL database. Web services are used to exchange real time data with the LOYTEC devices in the field.

The client can be installed locally on the computer together with the LWEB-900 server or it can run on computers that are distributed in the IP network. Alternati-

vely, LWEB-900 visualization functions can be accessed via a common web browser, allowing operation of the system via smartphone and tablet.

LWEB-900 provides each user with its own work environment. The user needs to log into the system and is presented with a view that is tailored to his tasks. The authorization system allows assigning individual access rights and functions to any user. Of course, users can be assigned to groups to facilitate the rights management. Integration with an existing LDAP-based user administration is also possible.

PC
LWEB-900

Ethernet/IP

L-DALI Controller

L-VIS Touch Panel
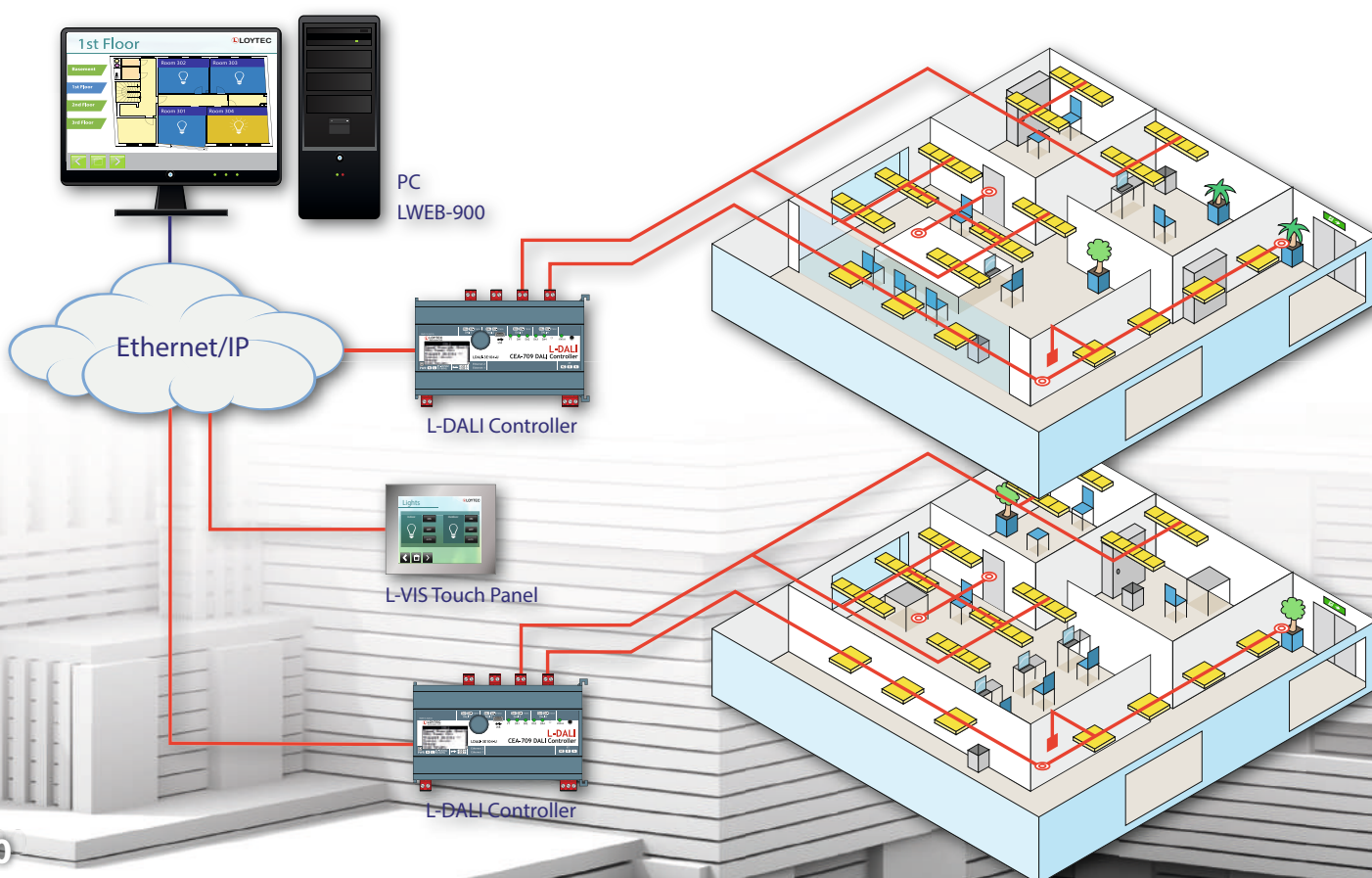
L-DALI Controller

Commissioning

Either commissioning is done via the web interface that is integrated in the L-DALI Controllers or using a PC based configuration software. The latter also allows an offline pre-configuration of the system: All parameters, group assignments, scenes, and connections for the lighting applications can be made beforehand in the office using a PC. Hence, commissioning on site (online) is limited to the assignment of physical devices. This can also be carried out conveniently through the web interface. Various wizards and a user interface, which is continually improved with the feedback from our customers, facilitate these tasks substantially.

If an LWEB-900 system is available, the configuration of the L-DALI controllers can be centrally managed in the LWEB-900 server.

DALI commissioning via L-DALI web interface
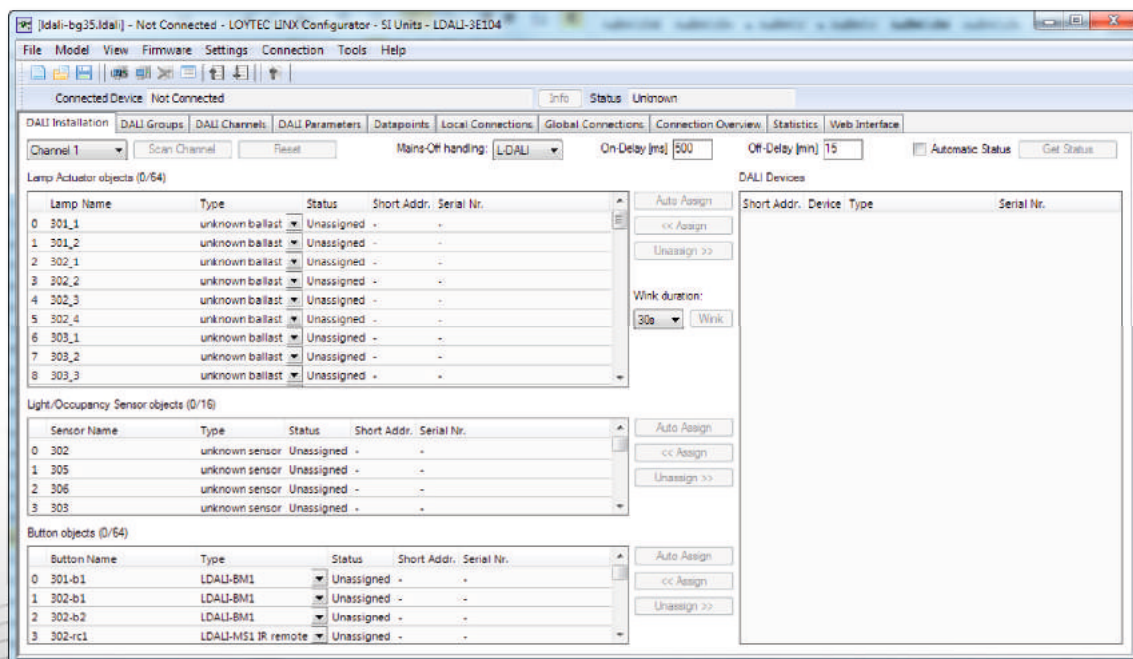
PC Configuration Software allows offline set-up of L-DALI Controllers

Office Buildings

- **Energy savings through presence based control**

- **Daylight harvesting for energy savings and comfort**

- **Automatic corridor lighting for safety and comfort**

- **Operation via conventional push-buttons, touch panels, or web-based**

- **Integration of emergency lighting**

- **Change lighting control strategy and parameters dynamically (e.g. depending on room usage or via scheduler)**

- **Increased well-being due to daylight simulation (adjusting color temperature depending on time of day)**

- **Sun blind control**

- **Integration with building management system**

- **Integration with multimedia system**

- **Monitoring energy usage and operating hours**

- **Easily reconfigure lighting from changing floor plans**

Iberdrola Tower, Bilbao

Iberdrola tower, located in Bilbao in the North of Spain, is a concrete, steel and glass giant that is 165 m (541 ft) high, consists of 41 floors and comprises a total of 50,000 square meters. The tower is the tallest building in the whole Basque country. Construction started in 2007 and was finished in 2011. The huge business center is designed as sustainable "green building" and gained a LEED CS 2.0 certification.

20,000 DALI luminaries – standard as well as emergency – and 5,000 automated sun blinds are controlled by 70 L-DALI controllers and 35 LINX-110 automation servers. Both standard DALI luminaries and emergency luminaries were integrated into the same system and even share the very same DALI channels.

Each floor contains up to 500 luminaries. Monitoring and control of standard lights comprises automatic and manual light level adjustment with consideration of different usage scenarios like occupancy, cleaning and night as well as alarms on lamp or ballast failure and recording of run hours. For the emergency lights the lamp value can be adjusted and the status of the lights is monitored. Alarms are generated in case of lamp or ballast failures. Run hours in normal and emergency mode, battery charge status and battery failure are accessible to the facility manager in real-time. Further, the system allows triggering function and duration tests manually or using a schedule for every single emergency light in the system. Among the resulting benefits are improvements related to maintenance, timely battery and lamp replacements, instant notification in case of lamp failures and the automatic testing of the emergency lighting system.

loytec.com/iberdrola

Location: Bilbao, Spain
DALI luminaires: 20,000
Sun blinds: 5,000
Technologies: DALI, EIA-709 (LonMark), IP
Companies involved: e-controls
LOYTEC Components: LDALI-Controller, LINX-110 Automation Server

e-controls®
electronic intelligent controls, s.l.

Transportation & Traffic

LUX Awards 2016 WINNER

- Energy savings through presence-based control

- Daylight harvesting for energy savings

- Integration of emergency lighting

- Change lighting control strategy and parameters dynamically (e.g. depending on room usage or via scheduler)

- Integration with building management system

- Automatic generation of maintenance lists and alarms in case of lamp failures

- Monitoring energy usage and operating hours

Manchester Airport

In the course of the refurbishment of Terminals 1, 2 and 3 of Manchester Airport, a modern DALI lighting system with constant light control and occupancy detection has been installed.

The lighting system is integrated in the airport's BMS and flight control systems via BACnet. This allows automatic configuration of the lighting control strategy at each gate according to the flight departure and arrival schedules, time of day, and ambient light level.

The integral solution includes the following features:
- Daylight and occupancy based lighting control
- Connection to the airport's "Flight Information System": The DALI lighting system is notified whether a gate is currently in use or not. The set point for the constant light control algorithm is raised for used gates whereas it is lowered for currently unused gates.
- "Maintenance-free" due to the use of LED technology

The lighting control system powers lighting only when the lighting levels drop below a pre-set threshold and when there is occupancy presence within these areas. Results are quite impressive, with energy reduction of up to 89 %, totalling to a reduction of seven GWh of electrical energy.

In November 2016 this Manchester Airport Project was honored with the LUX Award 2016 in London as „Project of the Year 2016" in the category „Industrial and Transport Lighting". The same L-DALI solution is now also implemented at Stansted Airport.

loytec.com/airport

Location: Manchester, Great Britain
DALI luminaires: 9,500
Technologies: DALI, BACnet, IP
Companies involved: Calon, Building Environment Controls
LOYTEC components: LDALI-ME204

Education

- **Daylight harvesting for energy savings and comfort**

- **Automatic or manual control**

- **Operation via conventional push-buttons, touch panels, or web-based**

- **Adopt light level and setup to usage scenario (e.g. class, presentation …)**

- **Integration with building management system**

- **Integration with multimedia system**

- **Automatic generation of maintenance lists and alarms in case of lamp failures**

- **Monitoring energy usage and operating hours**

High-School Wendelstein

High-tech high school, innovative model school, showcase project – Bavaria's most modern, multiple-award winning high school was seen as a first-class building right from the start. All systems – from the HVAC system to the energy data acquisition and the DALI lighting control system – were integrated into a single building automation system. All the different systems are connected via a CEA-709/LonMark system.

Around 2,000 DALI lamps are connected to L-DALI lighting controllers. The controllers manage constant light control in the class rooms and are able to independently regulate two lighting zones within each classroom (one at the window side, one at the corridor side). OSRAM DALI multi sensors are installed as part of the lighting system and used for constant light control. Due to the gateway function integrated in the L-DALI controllers the data provided by the multi sensors is available for the entire automation system and can be used by the various other applications in the building.

L-VIS touch panels are used in the gyms for lighting control. The school's facility manager uses an L-VIS touch panel to adjust the light levels of the luminaires in the entrance hall and in the corridors and also for monitoring all windows and doors in the building.

The facility management of the school's owner is responsible for collecting operation and resource usage data from the building. This allows analyzing the high schools' energy flux and monitoring and evaluating system status and performance. As part of this data acquisition L-DALI lighting controllers provide energy consumption data from the DALI lighting system.

NV-Connection

loytec.com/high-school

Location: Wendelstein, Germany
DALI luminaires: 2,000
Technologies: CEA-709
Companies involved: NV-Connection, Raimund Hoyer
LOYTEC components: LDALI-3E101, LDALI-3E102, LDALI-3E104, LVIS-3E100, LVIS-3E115

Healthcare

- Energy savings through presence based control

- Daylight harvesting for energy savings and comfort

- Operation via conventional push-buttons, touch panels, or web-based

- Integration of emergency lighting

- Adopt light level and setup to usage scenario (e.g. class, presentation …)

- Increased well-being due to daylight simulation (adjusting color temperature depending on time of day)

- Integration with building management system

- Automatic generation of maintenance lists and alarms in case of lamp failures

- Monitoring energy usage and operating hours

Rigshospitalet Kopenhagen

With more than 1,100 beds, Rigshospitalet is the largest hospital in Denmark. Different LOYTEC products were utilized as core elements in the design and implementation of a control and data acquisition system.

The goal was to implement a touch screen based control system for the various technical systems in operating rooms such as:

- OT lights – light intensity and light color
- Room lighting with dimming function
- Sun blinds
- Curtains
- Suction systems
- Room temperature
- Room pressure

The hospital was looking for a touch screen solution with an integrated graphical user interface that would allow regular staff like nurses or surgeons. to manage all technical functions themselves during a surgery.

For lighting control, L-DALI light controllers were used, while suction system, sun blinds and curtains in the operating room are integrated and controlled via L-IOB I/O modules. The application to fulfill the very specific requirements of this use case was realized using freely programmable L-INX automation servers. The open communication interfaces of the LOYTEC system allowed exchanging data on room temperature and the air pressure with an existing management system. All systems can be operated via LVIS-3E115 touch panels, which allow instant and flawless access to all above room functions.

GRUE + HORNSTRUP

loytec.com/rigshospitalet

Location: Copenhagen, Denmark
DALI luminaires: 1,200
Sun blinds: 400
Technologies: DALI, EIA-709 (LonMark), IP
Companies involved: Grue & Hornstrup
LOYTEC components: LINX-120, L-IOB I/O, LDALI-3E101, LVIS-3E115

Industrial Plants

- **Energy savings through presence based control**

- **Daylight harvesting for energy savings and optimal working conditions**

- **Integration of emergency lighting**

- **Change lighting control strategy and parameters dynamically (e.g. depending on room usage or via scheduler)**

- **Integration with building management system**

- **Automatic generation of maintenance lists and alarms in case of lamp failures**

- **Monitoring energy usage and operating hours**

Maintenance Facility Herdern

Swiss Federal Railways (SBB AG) extended its maintenance facility at the Herdern-Areal in Zurich-Altstetten to one of the most modern facilities for service and repair work. The building stands out with its unique industrial architecture and has a length of 425 m.

Correspondingly the requirements for the automation system were quite extensive. The focus was on high energy efficiency, maximum safety, and also highest availability. The strict environmental laws needed to be adhered to at all times. Additionally, an intuitive and simple user interface for the system was required.
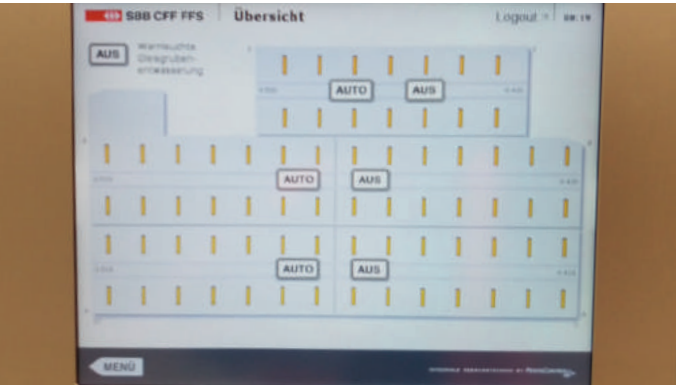
The integral solution includes the following features:
* Control and monitoring of lighting
* Control of the heating system
* Control of the ventilation system
* Control of smoke and heat extraction
* Control of the acoustic system
* Alarm detection and management

L-DALI controllers with daylight-based control were used throughout the entire complex and ensure ideal lighting conditions for the service workers at any time. As the devices execute the control functions locally, a high availability of the plant is guaranteed. The system is operated via 15 L-VIS touch panels mounted in different location throughout the site. Via these user interfaces the lights in the facility can be controlled. In addition they provide building management system like graphics with real-time values for all other building functions. The core of the system is the LWEB-900 building management system. It allows monitoring and visualization of the system status as well as the creation of schedulers and reports.

PENTACONTROL

Location: Zurich, Switzerland
DALI luminaires: 3,500
Technologies: DALI, EIA-709 (LonMark), IP
Companies involved: PentaControl AG
LOYTEC Components: LVIS-3E112, LDALI-3E102, LDALI-3E104, L-INX Automation Server, L-IOB I/O-Modules

Hotels

- **Automatic corridor lighting for safety and comfort**

- **Operation via conventional push buttons, touch panels or web-based**

- **Scene control for the right atmosphere**

- **Adjusting the color temperature to individual preferences and moods**

- **Sun blind control**

- **Integration with multimedia system**

- **Integration of emergency lighting**

- **Perfect product presentation by adjusting the light intensity and color**

- **Integration of colored effect lighting**

- **Integration with building management system**

- **Automatic generation of maintenance lists and alarms in case of lamp failures**

- **Monitoring energy usage and operating hours**

Roomers, Langestrasse 100 in Baden-Baden

Langestraße 100 in Germany is a newly built 5-star rated design hotel with 130 spacious rooms and suites, a state-of-the-art medical center with 15 medical specialists, an apartment building with 16 flats and a two-storey underground garage with 200 parking spaces. In 2010 "Roomers" in Frankfurt won the "hotel property award of the year".

The LOYTEC solution at Langestraße 100 uses room controllers, I/O modules, and KNX interfaces (LROC-100 Room Controllers, LIOB-100 I/O Modules, LKNX-300). So each hotel room has an automation system that can interact with other building systems, the booking system and the hospitality software via BACnet/IP. This solution was chosen for its open programmability and multiple interface support for: Ethernet, OPC UA, Modbus TCP, BACnet/IP, LON, Modbus RTU, KNX.

Via the OPC, the BMS provides the occupancy status to the room controllers, which can communicate to the L-STAT Network Thermostat, and displays the status (occupied or unoccupied). In addition, an L-VIS Touch Panel is configured to control the building complex and provide an alternative for controlling and visualizing the building. KNX system integration was one of the most important reasons why LOYTEC devices were selected for the Langestraße 100 project. When the L-ROC room controller processes incoming messages from KNX sensors, considerable energy savings are possible. For example, when a guest checks in, a welcome mode activates a predefined dimmed lighting mode, audio mode, and air conditioning is started, and then opens the roller shutter for optimizing guest comfort. In addition the L-STAT network thermostat shows the symbol „occupied". When the guest checks out, an unoccupied scenario is activated, which guarantees that energy is only used when actually needed.

loytec.com/roomers

Location: Baden-Baden, Germany
Topology: OPC UA, BACnet® IP,
Modbus RTU, Modbus TCP, DALI, KNX IP, KNX TP, M-Bus
Companies involved: PGA Gesellschaft für Prozess- und Gebäudeautomatisierungstechnik mbH
LOYTEC Components: u.a. LDALI-ME204-U Lighting Controller, LDALI-PWR4-U Power Supply, LVIS-3ME15 Touch Panels, L-STAT Network Thermostat, L-IOB I/O Module, L-ROC Room Controller, L-GATE Universal Gateways

Retail & Stores

- **Scene control for the right atmosphere**

- **Adjust light intensity and color for perfect product presentations**

- **Optimized window lighting based on outside lux levels**

- **Operation via conventional push-buttons, touch panels, or web-based**

- **Integration of emergency lighting**

- **Integration with building management system**

- **Integration with multimedia system**

- **Automatic generation of maintenance lists and alarms in case of lamp failures**

- **Monitoring energy usage and operating hours**

OBI Market Nuremberg, Germany

The OBI home improvement store in Nuremberg, a two-story building with a retail area of approximately 12,000 m^2, was built in February 2014. For lighting control the building automation system was equipped with a LOYTEC DALI lighting system. The complete automation system was integrated by the German company Nagel Gebäudetechnik GmbH.

Around 1,900 DALI luminaires are distributed all over the building and are controlled by LDALI-ME204 controllers that communicate via BACnet/IP. The luminaires are dimmed by the intelligent L-DALI controllers depending on the available daylight. The entire lighting of ground floor, upper floor, garden center, and parking are controlled via seven LDALI-ME204 and 19 lux sensors. The lighting system resulted in additional cost savings of up to 15 %. The L-DALI controllers are directly connected to the central building control system.

The entire building control system including lighting is controlled via 12" L-VIS touch panels that are integrated via BACnet/IP. The touch panels also display the current resource usage of the store like water and electricity usage. In addition, the resource usage of the previous day is shown in Euros directly on the display. This gives the store manager an immediate feedback on the savings achieved. If the benchmark values are compared before and after decreasing the dim level of the luminaires, the savings become evident.

loytec.com/obi

Location: Nuremberg, Germany
DALI luminaires: 1,900
Technologies: DALI, BACnet, IP
Companies involved: Nagel Gebäudetechnik GmbH
LOYTEC components: LDALI-ME204, LVIS-ME212

NAGEL GebäudeTechnik

L-DALI
Lighting Control Solutions

Modern lighting control systems must meet a number of requirements:

- Reduction of energy consumption
- Increased user comfort
- Comprehensive access to information for the building operator
- Easy adaption to changes in room usage or floor plan
- Seamless integration with building management systems

With more than 10 years of experience in lighting control, the LOYTEC lighting control solution covers all those aspects. By using standardized open protocols like DALI, OPC, BACnet, and LonMark, a LOYTEC lighting control system can be easily expanded or connected to systems of other vendors. This ensures that a LOYTEC based lighting control system is a save investment in the future.

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