Energy efficiency, safety and comfort with DALI lighting management
Speaker

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Market Management Building Automation
WAGO Kontakttechnik GmbH (Minden, D)
We connect your light
SMD terminal blocks for LED modules

For the Smallest Sizes
2059

For Manual and Automated Wiring Systems
2060

For Direct Power System Feed-In
2061

For Vertical Wiring
2075

2065 Reduced to the Essentials

2070 For Back-Side Wiring of LED Modules
We manage your light

DALI Light Management
Light intensity and light color

- have an impact on wellbeing, health and performance
- have psychological effects
- ensures security i.e. for crime prevention
- ensures safety i.e. for accident prevention
Different needs for different buildings and user groups

- Industrial Buildings
- Office Buildings
- Retail
- Hospitals
- Schools
- ...
Manual On/Off does not meet the different requirements
Manual On/Off does not meet the different requirements
DALI-2
Flexibility and efficiency through networking
DALI-2 in a connected world ensures …

- Interoperability through certified products based on IEC 62386
  - DALI Ballast
  - DALI Sensor
  - DALI Master
- Flexibility, as requirements change
- Cost-effectiveness through easy commissioning, predictive maintenance and active service support
- Integration of emergency lighting for maintenance tasks
- Energy consumption measurement
- Easy mapping to other communication protocols
Possible functions through DALI-2

Switching
- Power on/off (with and without watchdog)
- Latching relays
- Staircase feature
- Automatic light (motion detector)
- Twilight control

Dimming
- Automatic dimming
- Dimming with presence sensors

Lighting Control
- Constant light control
- Human-centric lighting (HCL)
- Daylight control:
  - Switching function
  - Staircase function
  - Advanced functions

Simple project documentation by mouse click

Time Functions
- Weekly
- Vacation
- Special switching programs
- Holidays

Slave Function
- Cross-communication between diffusers
- External virtual room
- External dimming value

Safety Lighting
- Single battery
- Central battery

- Precise energy consumption measurement
- Calculation of energy consumption for virtual room (VR)
- Measurement of total power; calculation per virtual room
System Architecture

- DALI-Channel: Interoperability through certified products based on IEC 62386
- Automation Level:
  - Interaction with sensors and actors supporting different communication protocols
  - Mapping to IP-Bases protocols
User Interface

- DALI Standard allows the design of user friendly interfaces for operation and maintenance
- Controlling ballasts
- Receiving status
- Setting parameter
DALI-2, for sure the perfect base for light management in an industrial building ....
and ....
...what about an Office Building?
Night
Artificial lighting
Room Automation and Control

Twilight
Use of daylight only
Room Automation and Control

Sunny

Use of daylight only
Room Automation and Control

Cloudy

Daylight with the support of artificial light
Room Automation and Control

Sensors

<table>
<thead>
<tr>
<th>Sensor</th>
<th>HVAC</th>
<th>Light</th>
<th>Blinds</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lux-Level</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room Temperature</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Presence detection</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Room Operation Unit</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Windows Contact</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>Wind / Rain</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Outdoor Temperature</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>Solar Radiation</td>
<td>X</td>
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</tbody>
</table>
Room Automation and Control

Energy efficiency, safety and comfort with DALI lighting management

MARKET MANAGEMENT BUILDING AUTOMATION | DIRK DRONIA 09/2019
Room Automation and Control

- Heating
- Cooling
- Light Row
- Blinds
- Master
- Slave

Energy efficiency, safety and comfort with DALI lighting management
The Room Automation slides before are more than a decade old!
Room Automation and Control

- Technologies have changed but not the concept!
- A lighting system can not be viewed in isolation!
DIRECTIVE (EU) 2018/844 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 30 May 2018

(15) It is important to ensure that measures to improve the energy performance of buildings do not focus only on the building envelope, but include all relevant elements and technical systems in a building, such as passive elements that participate in passive techniques aiming to reduce the energy needs for heating or cooling, the energy use for lighting and for ventilation and hence improve thermal and visual comfort.

Article 3
Transposition
1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 10 March 2020. They shall immediately communicate the text of those measures to the Commission.
Article 3

Adoption of a methodology for calculating the energy performance of buildings

Member States shall apply a methodology for calculating the energy performance of buildings in accordance with the common general framework set out in Annex I.

This methodology shall be adopted at national or regional level.
3. The methodology shall be laid down taking into consideration at least the following aspects:

... 

(e) built-in lighting installation (mainly in the non-residential sector); 
... 

(h) indoor climatic conditions, including the designed indoor climate;
4. The positive influence of the following aspects shall, where relevant in the calculation, be taken into account:
(a) local solar exposure conditions, active solar systems and other heating and electricity systems based on energy from renewable sources;
(b) electricity produced by cogeneration;
(c) district or block heating and cooling systems;
(d) natural lighting.
EN 15232:2017 (SIA 386.110:2017)

This European Standard specifies:

- European Standard describing how Building Automation is influencing the energy performance of buildings
- The standard states that the lighting must be considered in the context of shading and indoor climate control.
- There is no BAC efficiency classes A without a combined light, sun blind, and HVAC control
### Definition of BA classes

#### Energy Performance of Buildings

- Part 1: Impact of Building Automation, Controls and Building Management

<table>
<thead>
<tr>
<th>AUTOMATIC CONTROL</th>
<th>5</th>
<th>LIGHTING CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Occupancy control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 Manual on/off switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Manual on/off switch + additional sweeping extinction signal</td>
<td></td>
<td></td>
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<tr>
<td>2 Automatic detection (auto on)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Automatic detection (manual on)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>AUTOMATIC CONTROL</th>
<th>6</th>
<th>BLIND CONTROL</th>
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</thead>
<tbody>
<tr>
<td>6.1 Emission control</td>
<td></td>
<td></td>
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<tr>
<td>0 No automatic control</td>
<td></td>
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<tr>
<td>1 Central automatic control</td>
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<tr>
<td>2 Individual room control</td>
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<tr>
<td>3 Individual room control with communication</td>
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<tr>
<td>4 Individual room control with communication and occupancy detection (not applied to slow reacting heating emission systems, e.g. floor heating)</td>
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</tbody>
</table>

*In case of slow reacting heat (and cool) emission systems, e.g. floor heating, wall heating, etc. functions 1.1.3 (and 3.1.3) are allocated to BAC class A.*
# BAC efficiency classes

**EN 15232:2017**

<table>
<thead>
<tr>
<th>Classes</th>
<th>Heating / Cooling control (3)</th>
<th>Ventilation / Air conditioning control (4)</th>
<th>Lighting Control (5)</th>
<th>Blind Control (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>Individual room control with communication and occupancy detection</td>
<td>Demand-based room air temp. control (all-air systems)</td>
<td>Automatic detection (manual on) for occupancy control</td>
<td>Combined light/blind/HVAC control</td>
</tr>
<tr>
<td></td>
<td>Total interlock between heating and cooling control</td>
<td>Supply air flow control at the room level by occupancy detection</td>
<td>Light level / Daylight control via automatic dimming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demand based control of distribution water</td>
<td>Variable set point with load dependent compensation for supply air temperature control</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Variable speed pump control of distribution pumps in networks</td>
<td>H,x-directed free mechanical cooling control</td>
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<tr>
<td></td>
<td>Individual room control with communication and</td>
<td>Direct humidity control</td>
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<tr>
<td></td>
<td>occupancy detection</td>
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<td></td>
<td>Total interlock between heating and cooling</td>
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<td>control</td>
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<td></td>
<td>Demand based control of distribution water</td>
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<tr>
<td></td>
<td>Variable speed pump control of distribution pumps in networks</td>
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</tr>
<tr>
<td><strong>B</strong></td>
<td>Individual room control with communication between controllers</td>
<td>Demand-based room air temp. control (all-air systems)</td>
<td>Automatic detection (auto on) for occupancy control</td>
<td>Combined light/blind/HVAC control</td>
</tr>
<tr>
<td></td>
<td>Partial interlock (dependent on HVAC system)</td>
<td>Supply air flow control at the room level by time scheduling</td>
<td>Light level / Daylight control via automatic switching</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outside temperature compensated distribution water</td>
<td>Variable set point with outside temperature compensation for supply air temperature control</td>
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<tr>
<td></td>
<td>On/Off control of distribution pumps in networks</td>
<td>Free mechanical cooling</td>
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<td></td>
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<td>Direct humidity control</td>
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<tr>
<td></td>
<td>Individual room control</td>
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<tr>
<td></td>
<td>Outside temperature compensated control</td>
<td>Variable room air temp. control (all-air systems)</td>
<td>Manual on/off switch + additional sweeping extinction signal for occupancy control</td>
<td>Motorized operation with automatic blind control</td>
</tr>
<tr>
<td></td>
<td>Partial interlock (dependent on HVAC system)</td>
<td>Supply air flow control at the room level by time scheduling</td>
<td>Light level / Daylight control manual per room/zone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demand based control of distribution water</td>
<td>Constant set point for supply air temperature control</td>
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<td></td>
<td>Multi-State control of distribution pumps in networks</td>
<td>Free mechanical night cooling</td>
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<td>Dewpoint control of humidity</td>
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<tr>
<td><strong>C</strong></td>
<td>Individual room control</td>
<td>Manual on/off switch instead of occupancy control</td>
<td>Manual on/off switch instead of occupancy control</td>
<td>Motorized operation with manual blind control</td>
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<td>Outside temperature compensated control</td>
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<td>Demand based control of distribution water</td>
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<td>Multi-State control of distribution pumps in networks</td>
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<tr>
<td><strong>D</strong></td>
<td>No automatic control or Central automatic control</td>
<td>On/Off room air temp. control (all-air systems)</td>
<td>Central light level / Daylight control</td>
<td>Motorized operation with manual blind control</td>
</tr>
<tr>
<td></td>
<td>No interlock between heating and cooling control</td>
<td>No automatic supply air flow control at the room level</td>
<td>Manual operation for sun blinds</td>
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<tr>
<td></td>
<td>No automatic control of distribution water</td>
<td>No automatic supply air temperature control</td>
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<td></td>
<td>No automatic control of distribution pumps in networks</td>
<td>No automatic control of mechanical control</td>
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<td></td>
<td></td>
<td>No automatic humidity control</td>
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**Energy efficiency, safety and comfort with DALI lighting management**
EN 15232:2017 (SIA 386.110:2017)

Energy Performance of Buildings
– Part 1: Impact of Building Automation, Controls and Building Management

- Lighting in Building Automation must be seen in context with other systems and not as an individual system

![Diagram of automatic control systems]
“Light” in a connected world
Summary

- DALI allows
  - interoperability through certified products based on IEC 62386
  - flexibility, as requirements change
  - cost-effectiveness through easy commissioning, predictive maintenance and active service support
  - integration of emergency lighting for maintenance tasks
  - Energy consumption measurement
  - easy mapping to other communication protocols
  - designing user interfaces for easy commissioning and maintenance

MARKET MANAGEMENT BUILDING AUTOMATION | DIRK DRONIA 09/2019
Summary

- Especially in office buildings lighting can not be considered in isolation
- “Technical Building Systems“ including lighting are in European directives and standards
Thank you

See you at the LpS 2019 Expo (C13/D14)