WAGO Lighting Management

For Clever Lighting!

Contents

The potential for saving energy is particularly high in industrial environments because shift and night operation, as well as lack of daylight, increases the use of artificial lighting tremendously. This means that investments in lighting management are amortized rapidly. Learn how to control your system with WAGO Lighting Management to same time and money.


© iStock.com/jkitan

LIGHTING MANAGEMENT – IS IT EVEN NECESSARY?

Every lighting system is over-dimensioned at the time of commissioning on day one to ensure it will also provide the minimum lighting required on day X (maintenance factor). However, without control, potential savings simply vanish. It is therefore quite clear that light not only influences our feelings of comfort, but it also affects the bottom line. A cost analysis should also include operating costs (energy, maintenance and service costs), which greatly exceed initial investment costs for building automation. From a user's point of view, no one would want to go without some type of regulation or control – being limited to switching lights on and off is a remnant from the last century. State-of-the-art systems can be controlled and serviced independently without great effort; for example, converting the hall equipment and changing the lighting conditions. Moreover, integrating the lighting equipment into a master system is very practical for functions like adapting your lighting to your production times. Naturally, the most important thing is guaranteeing sufficient lighting at the workplace to ensure safe working surroundings.

Good reasons for Lighting Management

Ergonomic reasons:
- Increase safety
- Provide orientation
- Facilitate utilization
- Increase well-being
- Improve convenience

Psychological effects:
- Attract attention
- Increase motivation
- Elevate moods

Economic aspects:
- Save energy
- Reduce costs
- Decrease work required for operation and service; simplify handing via browser
- Intelligent networking of systems
- Increase value of building

WAGO offers a particularly user-friendly system for operating and servicing your lighting system - stay in control of your equipment!

Potential Energy Savings for Interior Lighting

#01 Older system from 1980s with three 26 mm dia. fluorescent tubes with low-loss ballasts, older lights with white grids — 20 %

#02 New system, state-of-the-art, 16 mm dia. fluorescent lights with electronic ballast — 55 %

#03 Modern LED lights — 65 %

#04 With daylight control — 75 %

#05 With presence detection and daylight control — 80 %

Savings potential for interior lighting: Reference is to an older system from the 1970s using standard, 38 mm dia. fluorescent tubes with conventional ballasts, older lights with soft-opal reflector (source: licht.de)

Therefore, many governments are spearheading increased regulations for lighting efficiency. In Germany, the Energy Saving Ordinance (EnEV) implements various EU directives regarding building efficiency. It considers energy consumption values for heating, ventilation, cooling, hot water supply and, naturally, lighting. Certification points such as DGNB, which also evaluate the criteria of sustainable construction, include in their assessment important lighting management factors, such as building-related life cycle costs, flexibility and conversion capability, as well as convenience features, such as visual comfort. In addition to energy consumption goals, legal requirements, costs, lighting quality and user convenience all have parts to play in the decision. What stated as a simple "yes-no" question transforms into a complex field of topics.

Subject World	Criteria Group	Criterion Number	Criterion	Impact Factor	Percentage of Total Rating
Economic Quality (ECO)	Life cycle costs (ECO 10)	ECO1.1	Building-related life cycle costs	3	11.3 %
	Value development (ECO20)	ECO2.1	Flexibility and conversion capability	2	7.5 %
	Value development (ECO20)	ECO2.2	Commercial viability	1	3.8 %
Socio-Cultural and Functional Quality	Health, comfort and sustainability (SOC10)	SOC1.4	Visual comfort	1	2.5 %
	Health, comfort and sustainability (SOC10)	SOC1.6	Quality of sojourn, indoors/outdoors	2	5 %
	Health, comfort and sustainability (SOC10)	SOC1.7	Safe	1	2.5 %
Technical Quality	Quality of technical execution	TEC1.4	Adaptability of technical system	2	5 %
Process Quality	Quality of planning (PRO10)	PRO1.5	Prerequisites for optimum utilization and management	2	1 %
	Quality and construction	PRO2.3	Proper commissioning	3	1.4 %

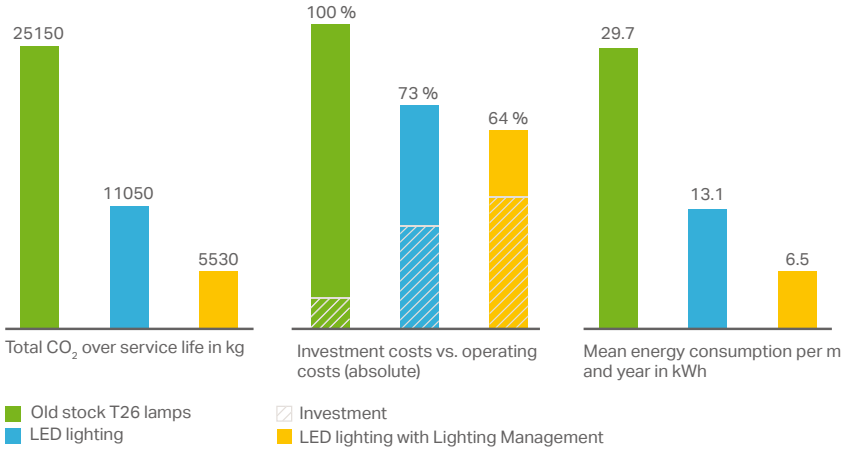
Weighting of criteria according to DGNB Hall Construction: New Construction of Industrial Facilities, Type 1, Version 2015.

STAY IN CONTROL OF YOUR SYSTEM

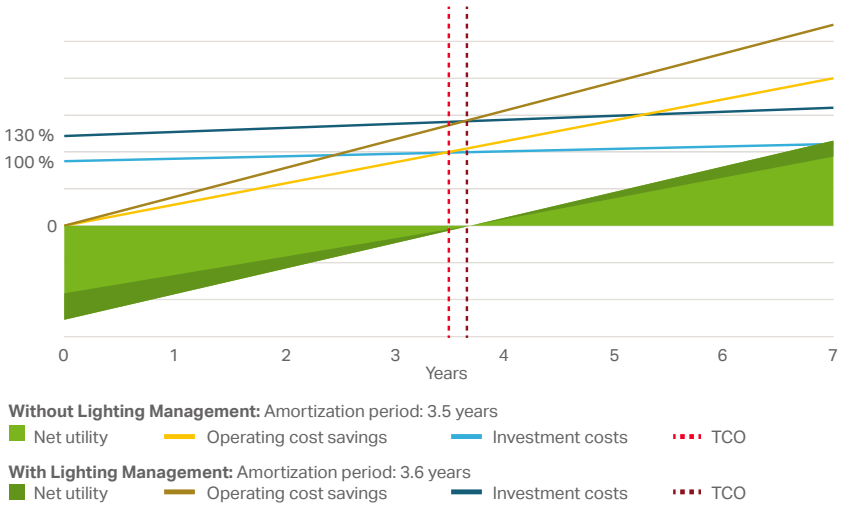
Monitoring and Service for Continuous Functionality

WAGO Lighting Management is the optimum solution for both new systems, as well as for retrofits. Whether it is a small production facility, or large logistics systems, our scalability offers precisely the right concept to meet your requirements. Reduce lifecycle costs through efficient light management! Many helpful features allow autonomous, independent operation of your lighting system, for example, wizard-based configuration provides support for commissioning on your own. Do you want to convert certain areas in your plant? No problem! Your plant personnel can simply reassign the virtual rooms with the web GUI. Moreover, an integrated time management feature allows you to adapt your lighting system to the hourly time schedules for your production. The comprehensive diagnostic features including maintenance charts, alarm tables, status displays and recording of operating time provide additional support for scheduling maintenance. You can also easily record energy data for lighting very simply to comply with the Energy Services Act (EDL-G). Above all, it is important that the focus of this solution remain on the user – at the bottom line a large selection of functions and interface options serve to make life easier.

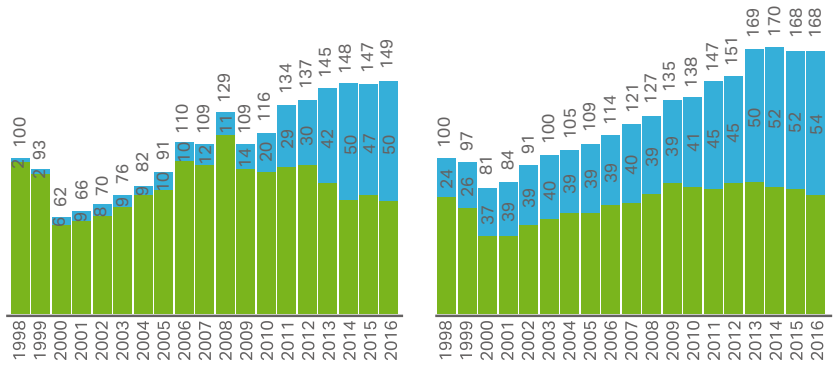
Energy Consumption and Costs for a Warehouse in Operation 24 Hours a Day



Cost/Earnings Curve Using Warehouse with 24 Hour Operation as Example



Development of Electricity Prices (Index 1998=100)



Source: VEA, BDEW; date: 01/2016


© hacohob/Fotolia.com

OUR CONCEPT

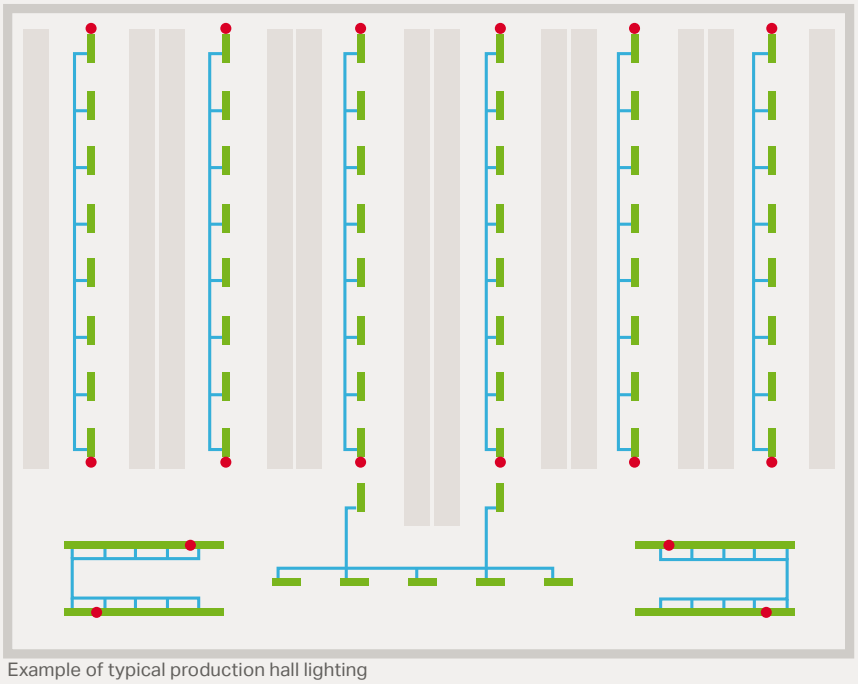
The Solution for Efficient Lighting Management in Production and Storage Facilities

Modern lighting management offers more than mere reductions in energy and costs, it simplifies economy and resource conservation with user comfort and flexibility.

Our Concept
WAGO Lighting Management is a practical, proven concept based on predefined hardware and preconfigured software which greatly simplifies both planning, commissioning and operation. The basic idea: WAGO Lighting Management is based on different lighting requirements in warehouses and production facilities.
For example, a production facility is divided into virtual rooms in which the light can be flexibly adapted. Each virtual room receives signals from sensors and actuators in order to automatically set the appropriate light intensity. By using the virtual rooms, conversions and room remodeling can be implemented quickly and simply via Web configuration.

Operation
WAGO Light Management features a Web interface allowing you to easily create and edit virtual rooms. Do you need to illuminate a production line, hallway or a storage area? No problem – simply create three different rooms with the required functions. Parameter values are stored on an SD card or a backup server via FTP. The values can be forwarded to a master building control system or to a production control center.

Its foundation is an intelligent lighting control system, which ensures that the correct light is available in the right amount at the right time by using daylight sensors, presence sensors and thoughtfully programmed lighting scenarios.



Example of typical production hall lighting

WAGO Lighting Management significantly reduces the overall costs of new installations and conversions. WAGO Lighting Management provides the perfect combination of high-quality hardware and intuitive custom software! Reduce lifecycle costs with quick and simple commissioning, excellent diagnostic and service capabilities, as well as simple adaptation of lighting situation to varying requirements.

Works photo, WAGO

WAGO Lighting Management Benefits:

- Reduce lifecycle costs through efficient light management
- Adapt to all equipment requirements
- Commissioning via easy wizard-based configuration
- Simple, programming-free conversion
- Connection to higher-level management and control systems in industrial or technical building environments

Do you need to illuminate a large area?
No problem! Our Lighting Management application allows you to illuminate nearly 3000 m² depending on the type of lamp. For larger areas, it is simple to link a number of controllers with one another.

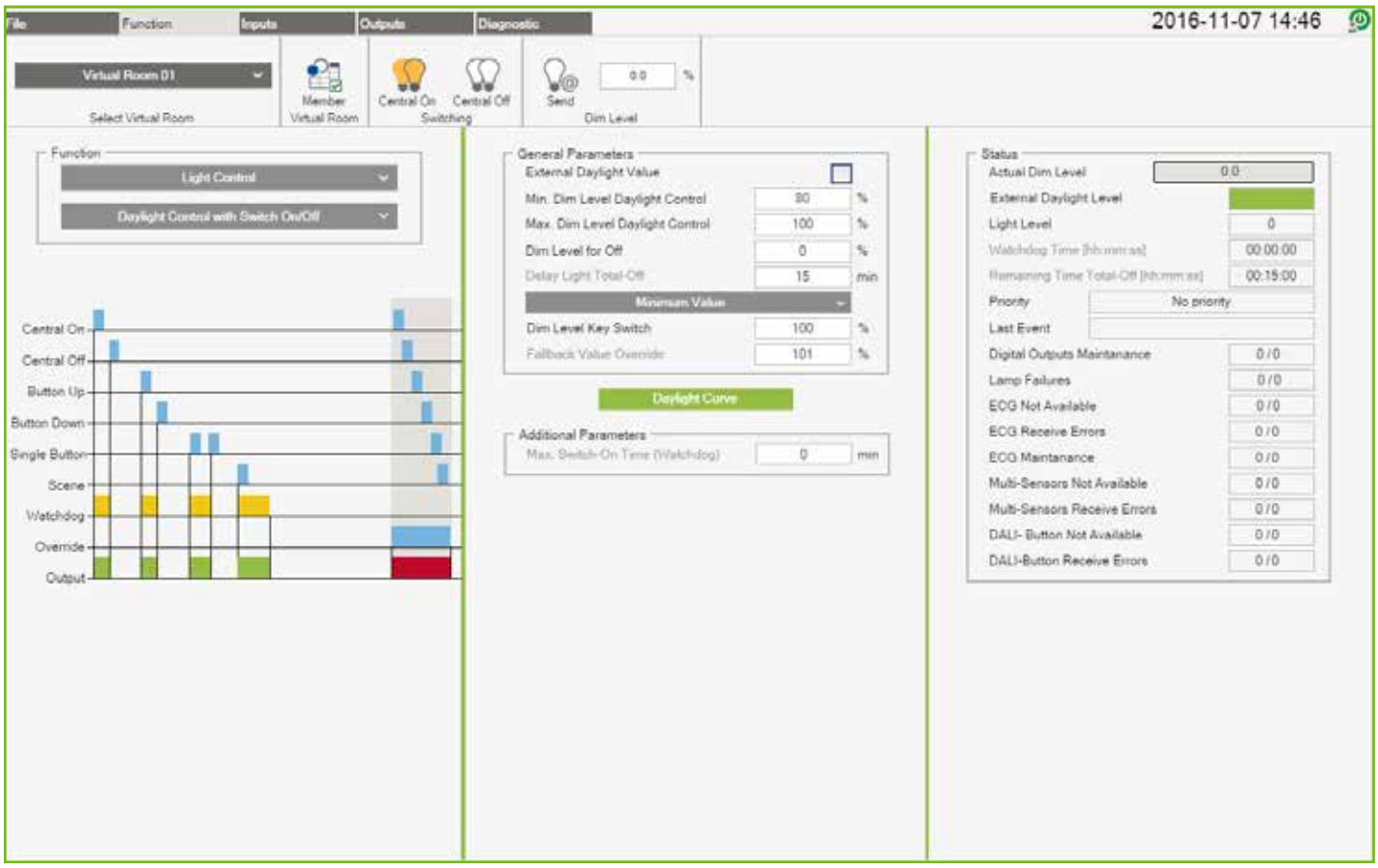
FUNCTIONS

Clever Lighting Management Today

Lighting Management by WAGO - Automated buildings support optimum light control! Browser-based software makes it easy to replace default parameters with custom settings any time adaptations are required. Connections to higher-level management and control systems in industrial or technical building environments are also supported. Moreover, simple connection is provided to master controls or building control systems via TCP/UDP Modbus protocol.

Clear Input Screen:
For basic parameters, screen forms with default settings are pre-populated and operating states are displayed.

- Setpoint value specification
- Maximum and minimum control limits
- Actuator and sensor configuration
- Operating status indication



Screenshot – Example: Daylight control

Function Summaries:

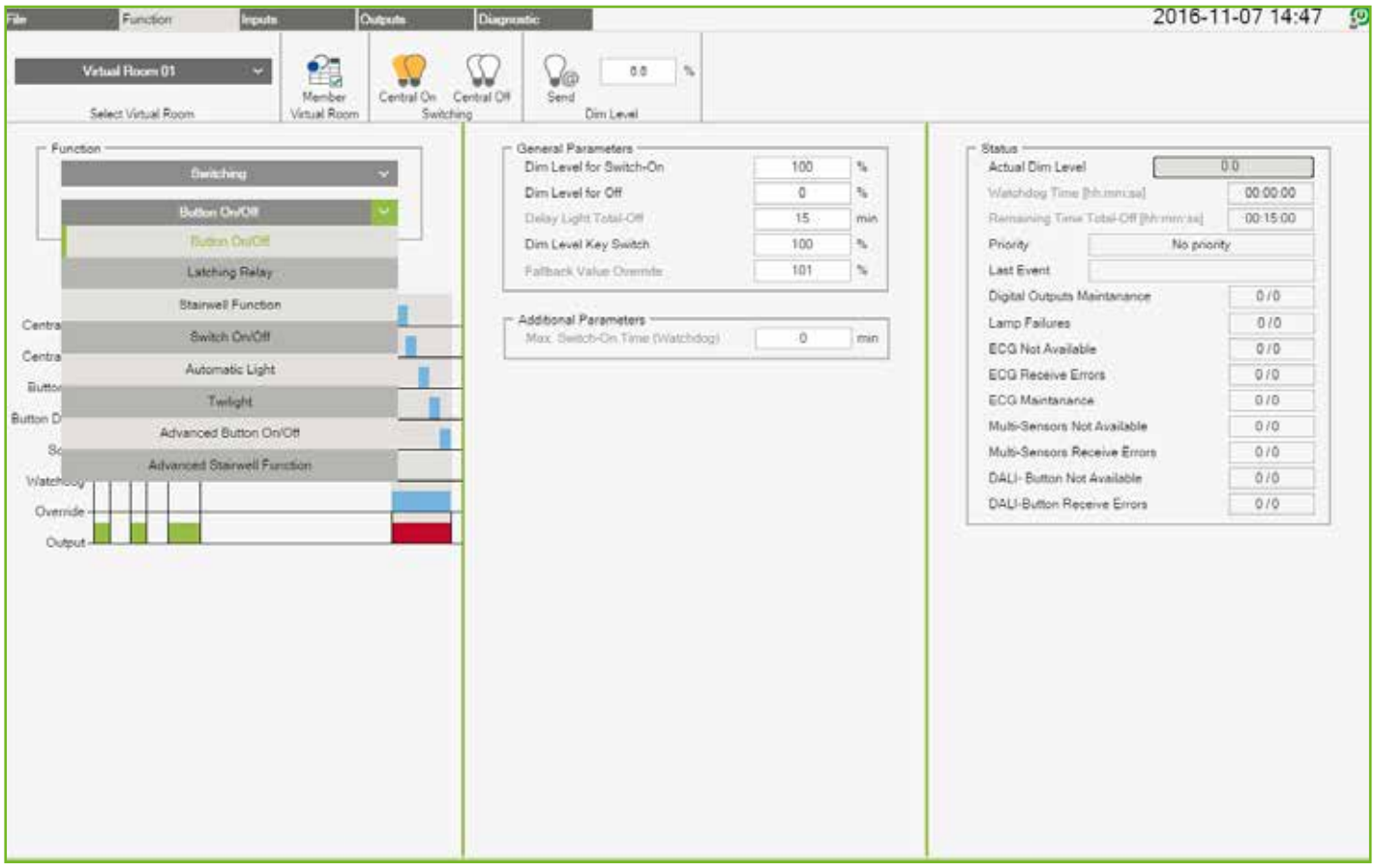
Switching
- Power On/Off (with and without watchdog)
- Latching relays
- Staircase feature
- Automatic light (motion detector)
- Twilight control

Dimming
- Automatic dimming
- Dimming with presence sensors

Lighting control
- Constant light control
- Daylight control:
  - With switching feature
  - With staircase feature
  - Supplemental features

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

Slave feature
- External virtual room
- External dimming value



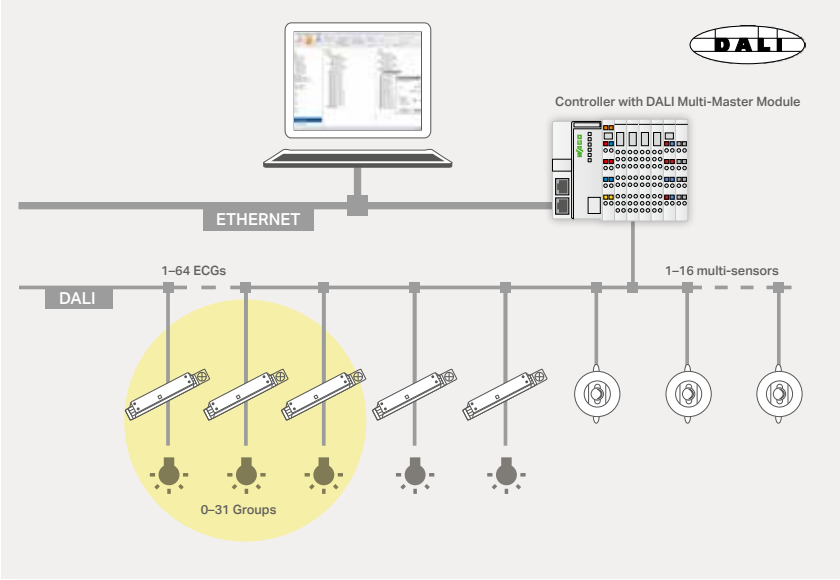
Screenshot – Example: Switching

FUNCTIONS

Standard Features Include DALI and EnOcean

DALI

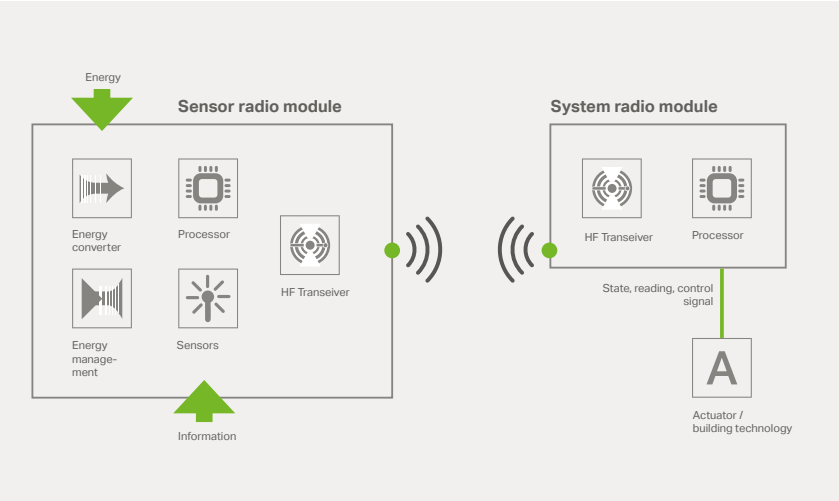
Digital Addressable Lighting Interface (DALI) is a technical standard for controlling lighting devices (e.g., electronic control gears). DALI features digital communication and streamlined installation. It meets lighting requirements, such as switching, dimming, light grouping or status information feedback.



DALI system layout

EnOcean Radio Technology

Battery-free EnOcean technology transmits short telegrams and requires very little energy to send radio signals. Transmitters use electrodynamic/ thermoelectric (energy converters) or photovoltaic (solar cells) energy-harvesting technologies. Characteristic features include a long range up to 30 m indoors and 50 m in production halls) high transmission reliability (short telegrams) and multiple telegram transmission.



EnOcean system layout

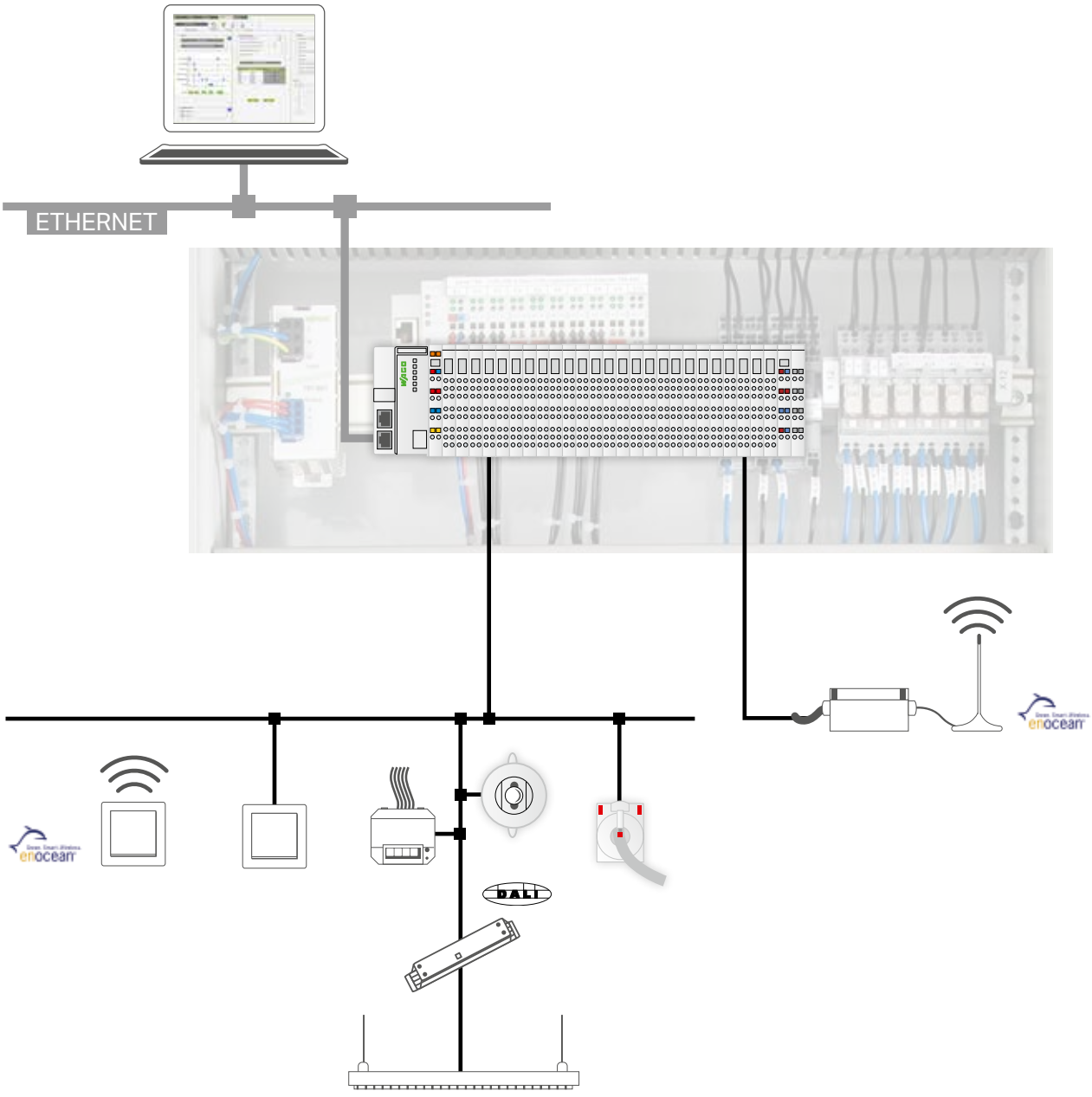
If you need more information on DALI or EnOcean, see our attachment or go to:
www.wago.com/dali
wago.com/enocean

CLEVER LIGHTING

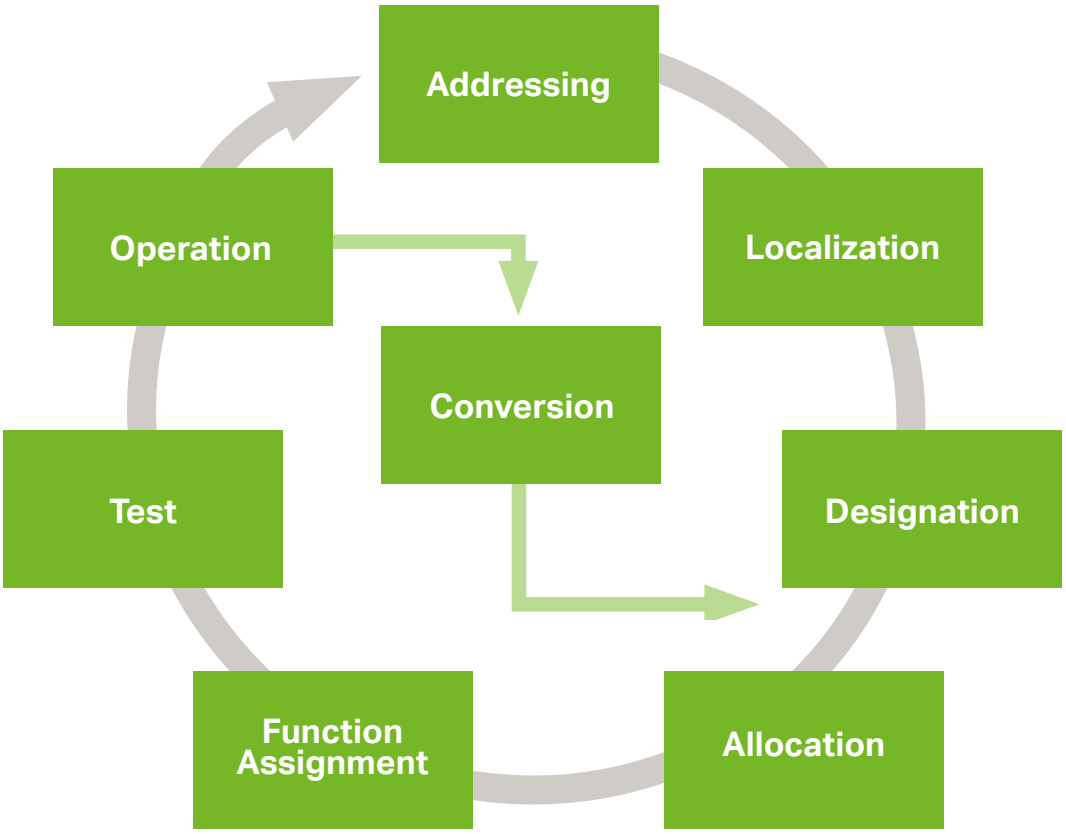
From Planning to Commissioning and Operation

Planning

Government regulations ensure that important sustainability objectives are met. For this reason, it is necessary to observe all current standards when planning a lighting system. For lighting planners, specifications in application standards, such as DIN EN 12464-1, are mandatory for indoor workplaces. This requires that artificial light be produced with minimum energy consumption. The energy certificate required by the Energy Saving Ordinance (EnEV 2014) considers lighting in the balance of the total building energy requirements. WAGO Lighting Management also helps you achieve the objectives specified for industrial buildings in DGNB, by positively impacting 46 % of the assessment criteria.



WAGO Lighting Management system layout



Simple workflow - wizard-based commissioning

Wizard-Based Commissioning for Simple Workflow

Addressing:
- DALI and EnOcean devices

Localization:
- Detection and sorting of DALI components

Designation:
- Of inputs and outputs according to equipment marking system

Allocation:
- Of inputs and outputs according to rooms

Function Assignment:
- Assignment of functions in room

Test:
- Configuration check

Operation:
- Planning diagnostic and service features

Conversion:
- Changing assignments or functions

Easy Commissioning:
- Classification of rooms using a Web browser view.
- Configuration with standard PC
- Without installing additional applications programs
- Automatic detection of modules used and associated components (lamps, sensors)
- Automatic documentation during commissioning
- Configuration and documentation with Microsoft Excel via import/export

ORDER OVERVIEW

Scope of Hardware	
1 x	PFC200 Controller, 750-8202/000-012
10 x	DALI Multi-Master Module, 753-647 for connection of DALI Multi-sensors, push buttons and ECGs
32 x	Any combination of digital outputs for conventional operation, such as relay control
64 x	Any combination of digital inputs for conventional sensors, light buttons, key switches
1 x	Real-Time Clock Module, 750-640
1 x	EnOcean Gateway, 750-652
1 x	Energy Measurement Module, 750-495
1 x	End Module, 750-600

ACCESSORIES

DALI Accessories	
DALI Sensors	WAGO DALI Multi-Sensor Kit
	DALI Sensor Coupler
	Sensor Adapter and DALI HIGH BAY
	Sensor Adapter and DALI Vision
	DALI LS/PD LI Built-In Light Sensor
	Radar Sensor and DALI Sensor Coupler
Other DALI Components	DALI Sensor Coupler E – Multi-Sensor Gateway
	DALI XC Key Couplers

EnOcean Accessories
RS-485-EVC Radio Transmitter/Receiver
EnOcean Repeater
EnOcean Radio Transmitter, 2-channel lighting control
EnOcean Radio Transmitter, 4-channel lighting control

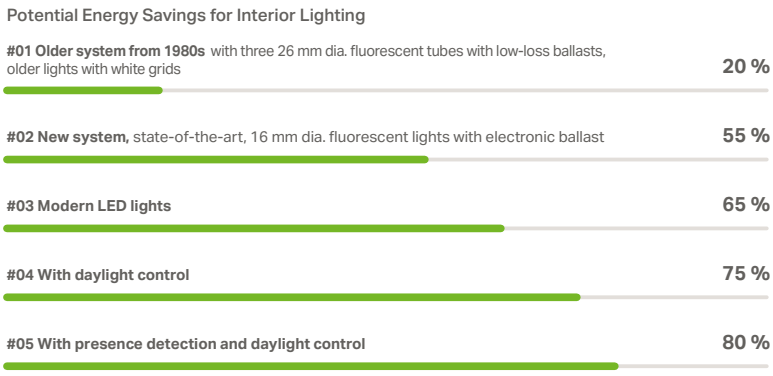
Interface Accessories
EPSITRON® COMPACT Power Supply
DALI Power Supply (with more than one module up to five modules)
DALI Power Supply with one DALI Module
Terminal block assembly for current and voltage transformers

Other
Time synchronization - GPS/DCF receiver
SD memory card, SLC-NAND, 2 Gbytes

Detailed information on accessories is available at: www.wago.com/lighting-management

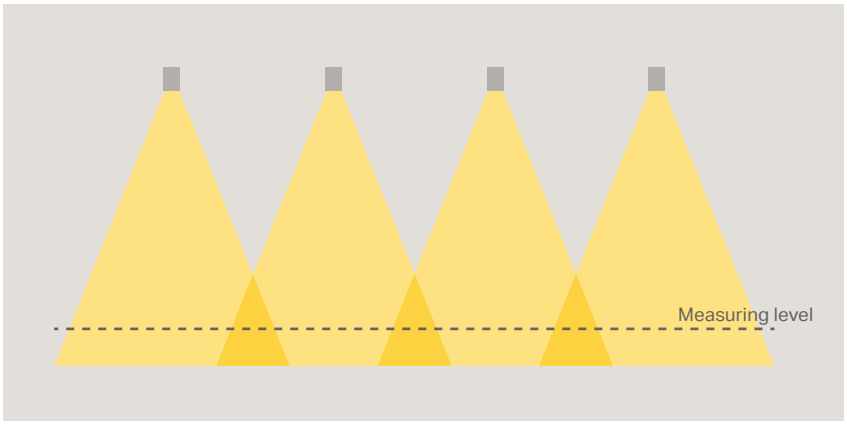
INTERESTING FACTS - GENERAL QUESTIONS

Why do I need to install a controller when using LED lamps?
Because controlling the lighting provides additional savings.



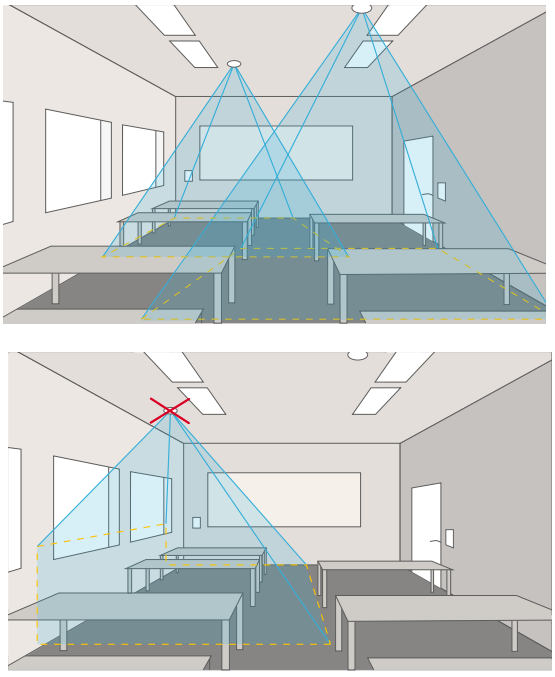
Savings potential for interior lighting: Reference is to an older system from the 1970s using standard, 38 mm dia. fluorescent tubes with conventional ballasts, older lights with soft-opal reflector (source: licht.de)

What intervals should be observed when installing lights in a high hall?
The important factor is uniform illumination, which depends on the lamp. In high halls, the cones of light should begin to overlap at a greater height – not at the assessment level. It is best to have an expert calculate the lighting requirements and complete the planning based on current standards and regulations, such as the Technical Regulations for Workplaces (ASR).



Hall illumination

How should sensors be placed?
What needs to be observed?
You should maintain a certain distance from the light so the sensor is not affected by the brightness of the light. It is important to note that the sensor measures the brightness directly at the device.
Tip: Do not attach sensors directly above surfaces with irregular reflection. For example, if a sensor is attached directly above a welding workplace, the irregular brightness will cause the sensor to continuously adapt the brightness, making it dark while welding then increasing the intensity again.



Sensor positioning in room

INTERESTING FACTS - GENERAL QUESTIONS

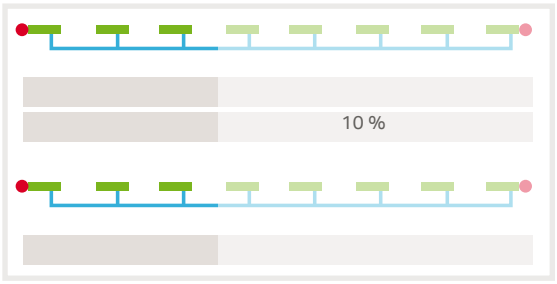
How can the correct brightness value be measured at the workplace?
Special devices are specified in the standards for measuring the light intensity. For example a sensor can be placed on a table and the brightness measured there, allowing the light to be adjusted to the desired value.

What needs to be observed when illuminating production facilities and warehouses?
Daylight should be harnessed to allow work with maximum energy efficiency and save lighting.
In this case, it is important to know that 90 % of all halls do not have uniform light incidence. For this reason, it is necessary to install a number of sensors.

What needs to be observed with sensors in high bay warehouses?
Ceiling heights of up to 14 meters are typical in high bay warehouses, placing high demands on technical equipment. It is necessary for the sensors to measure reliably from such heights while detecting motion only in the assigned aisle. The only sensors suitable for such purposes are infrared sensors - usually also called High Bay sensors.
Tip 1: The sensors can be linked with one for monitoring even larger areas.
Tip 2: Too many sensors and different types of sensors should be avoided.

What needs to be observed with sensors in warehouses?
Artificial light is frequently used for illuminating storage areas. Often the light is on for the entire shift, even though it is only required for short periods. Presence sensors or intelligent controls switch the light on only when required. Otherwise, it is off or can be dimmed to a 10 % standby mode.
For example, if you have an aisle a forklift only drives in occasionally, the lighting is set to 10 %, so the driver does not drive into a black hole before the presence sensor detects the vehicle as it turns into the aisle. If you do not have any incidence of extraneous light, motion sensors are perfect for switching the artificial light.
Important: The space must be covered by the sensor's detection zone.

What needs to be observed regarding illumination for night shifts?
If, for example, only 1/3 of the hall needs to be completely illuminated for the work, the Rules for Workplaces (ASR) require the remaining 2/3 of the hall to also be illuminated; here a value of 10 % is also recommended.



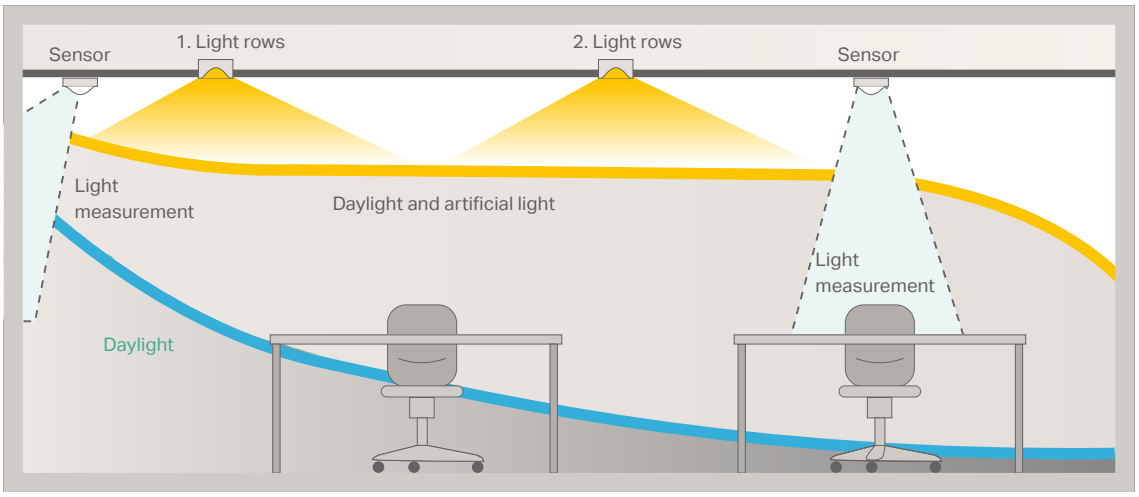
Illumination of a hall section during the night shift

There are conventional sensors and sensors for high ceilings. Which type is suitable for which applications?
A normal sensor can be used for ceiling heights up to 4.5 m. High Bay sensors are intended for maximum heights of up to 13 meters.

What needs to be observed regarding incidence of light from outdoors? How does a controller work using outdoor brightness?

A daylight circuit uses the incident daylight and automatically switches the light to a minimum illumination intensity when activated. Artificial lighting is only switched on or gradually and continuously intensified when there is insufficient daylight. If there is enough daylight, the lighting may even be switched off completely. This is accomplished with the aid of a brightness measuring sensor, which relays the value to the control to increase or dim the light. If the daylight present varies, excessive switching operations can be avoided by using a time delay. This feature means the lighting does not always have to provide the full power, thus saving energy. It also ensures a constant lighting level at greater room depth (constant light illumination).

Important: The sensor should measure as much natural light as possible and not be placed to close to a light fixture.



Example: Incidence of light from outdoors

Is there a rule of thumb for the savings potential?

Yes, the indicator LENI (Lighting Energy Numeric Indicator) stands for the actual energy consumption of a lighting system in kWh per square meter and year. The LENI value is determined as described in the specification EN 15193 (Energy performance of buildings - Energy requirements for lighting).

As a matter of principle, the following factors affect the energy savings potential:

- Use of daylight
- Use of presence sensors
- Practical control of lighting
- Annual utilization times
- Illuminated area
- Energy efficient lights

INTERESTING FACTS - GENERAL QUESTIONS

What needs to be observed with DALI?
It is important to note that DALI is not simply DALI. The standardized digital interface for electronic ballast units is subject to the IEC 62386 Standards – ensuring that the systems function properly regardless of the manufacturer. Not all manufacturers meet these standards.

How must I wire DALI lines?
Supply and control wires can be routed together in the same cable. The wiring can be implemented in series, radially or in a hybrid configuration. Ring circuits should be avoided completely.

How large can the DALI network be?
A maximum of 64 actuators and/or a maximum of 16 groups is permissible per DALI line.

Can I use a Y(ST)Y cable or other extra low-voltage cables for the DALI bus?
Unfortunately no, because this is only an extra low voltage cable and the DALI bus line must be laid out for 230 volts, including the specified dielectric strength. Detailed information is also given in IEC 62386.

Which cable lengths must be observed?
The maximum cable length is determined by the maximum permissible voltage drop in the DALI line; it is defined at a maximum of 2V. This corresponds to a maximum line length of 300 m, with a 1.5 mm² cable cross-section.

Which standards do subscribers in a DALI line have to fulfill?
DALI subscribers are subject to IEC 62386.

What are the minimum lighting intensities required?
See appendix or Technical Regulations for Workplaces (ASR).

What is the burn-in period?
Fluorescent bulbs have a burn-in period of 100 hours.

Is it also necessary to burn in LED lights?
No.

What does a lighting control system cost in comparison to a conventional system? Is there a price based on floor space?
This is a typical question for planning lighting systems. An expert will be happy to complete an amortization calculation for you.

Are subsidies available?
Information on current subsidy programs is available at: www.bafa.de

INTERESTING FACTS – QUESTIONS ABOUT WAGO LIGHTING MANAGEMENT

Which sensors should be used? Can other sensors be connected?
It is best to use the specified sensors to ensure that the system functions properly. We cannot guarantee that other sensors will function properly.

What needs to be observed when ordering sensors?
Motion sensors detect movement of humans and vehicles such as fork lifts. If it is necessary to measure the brightness as well, e.g., for daylight control, an additional adapter is required.

What interfaces are there to the building control system or other systems?
Data can be transferred to the building control system via MODBUS. Data can also be transferred via MODBUS to other controllers or systems such as BACnet or KNX.

How is the WAGO Lighting Management system put into operation?
The system can be commissioned using a Web GUI; no additional software is required.

Who commissions the WAGO Lighting Management system?
It is not necessary to program the lighting management system, making it easy to commission yourself. Your WAGO solution provider will be glad to help. We also offer a one-day course of training.

How high are the costs for commissioning?
The system is laid out so that the purchase price covers all costs for licenses; there are no additional costs for software or licensing. Moreover the system offers an interface for bulk processing making commissioning very efficient.

Are there any additional costs for hardware?
No, you purchase a controller and the required number of I/O modules and the light management system is ready to use.

Can other I/O modules be added?
You can add the following I/O modules, and detailed specifications are also given on the order summary page:
- 10 x DALI Multi-Master Modules
- 64 x Digital Inputs
- 32 x Digital Outputs
- 1 x Real-Time Clock Module
- 1 x Serial Interface for EnOcean Communication
- 1 x 3-Phase Power Measurement Module

Are tender texts available for the complete system?
Yes. Follow the link:
wago.com/lighting-management.

Is there a model circuit diagram for the switch cabinet in form of a WS-CAD or ePlan document?
Yes. Follow the link:
wago.com/lighting-management.

Who provides me a complete system?
Ask our solution providers.

GUIDE VALUES FOR LIGHTING

EN 12464-1 covers the requirements for lighting work environments in interior spaces.

Type of Room, Task or Activity

Traffic Areas and General Areas in Buildings		E_m	UGR_L	U_o	R_a
Traffic zones inside buildings	Circulation areas and corridors	100	28	0.40	40
	Stairs, escalators, travelators	100	25	0.40	40
	Elevators, lifts	100	25	0.40	40
	Loading ramps, loading bays	100	25	0.40	40
Rest, sanitation and first aid rooms	Canteens and pantries	200	22	0.40	80
	Restrooms	100	22	0.40	80
	Exercise rooms	300	22	0.40	80
	Coatrooms, washrooms, baths, toilets	200	25	0.40	80
	Sanitation rooms	500	19	0.60	80
	Infirmaries	500	16	0.60	90
Control rooms	Rooms for facility installations, switchgear rooms	200	25	0.40	60
	Telex and mail rooms, telephone switchboards	500	19	0.60	80
Store rooms and cold stores	Store and stockrooms	100	25	0.40	60
	Dispatch packing handling areas	300	25	0.60	60
High-bay warehouses	Unmanned gangways	20	-	0.40	40
	Manned gangways	150	22	0.40	60
	Control station	150	22	0.60	80
	High-bay front	200	-	0.40	60

Equation Symbol for Assessment Values:

DIN EN 12464-1 defines equation terms for technical light evaluation values for general use.

- Em: Warning value for (mean) light intensity
- Ez: Mean cylindrical luminous intensity
- Ex: Mean vertical luminous intensity
- UGR_L: UGR limit for evaluation of glare
- U_o: Uniformity, corresponding to g1
- R_a: Color rendering index

CONTACT

Technical Support
WAGO technical support employees are available to help customers from guidance through product selection via telephone support to commissioning and on-site troubleshooting.
Customers benefit immediately from the knowledge of WAGO experts and complete their projects much more quickly.

WAGO Provides Advice and Support with:
- Product selection
- Product commissioning
- Troubleshooting
- All technical questions about WAGO products and solutions

As a WAGO Customer, You Benefit from First-Class Support:
- Qualified fieldbus specialists
- Troubleshooting
- Spare parts service
- Contact by phone, online or using the form

Project Support
WAGO's technical support offers consultation and project planning services to help devise the best possible solutions for your custom building automation and installation projects. Our experienced team of professionals will gladly help you implement your projects with WAGO products.

Planning and Project Design:
- Conceptual design
- Network planning
- Application design
- Component selection
- Quote generation

WAGO Helps Customers with:
- Advice during the construction project's planning phase from experts with years of project experience
- Creation of customized solutions for large-scale projects that ensure technical and financial success
- Technical support while implementing building projects

WAGO Kontakttechnik GmbH & Co. KG
Germany
Technical Support AUTOMATION
Phone: +49 (571) 887 555
Fax: +49 (571) 887 8555
Email: support@wago.com

Project Sales Building Automation
Gutenstetter Straße 8b
90449 Nuremberg
Phone: +49 (571) 887 77771
Fax: +49 (571) 8878 77771
Email: projektvertrieb@wago.com

Note: For more information, please visit our Website at
www.wago.com/lighting-management

WE INNOVATE!

0888-0179/0100-6901 – WAGO LIGHTING APPLICATION 1.0 US – 60321850 – 11/2016-00 – Printed in Germany – Subject to design changes

WAGO Kontakttechnik GmbH & Co. KG
Postfach 2880 · 32385 Minden
Hansastraße 27 · 32423 Minden
info@wago.com
www.wago.com

Headquarters	+49 571/ 887 - 0
Sales	+49 571/ 887 - 222
Order service	+49 571/ 887 - 44 333
Fax	+49 571/ 887 - 844 169