



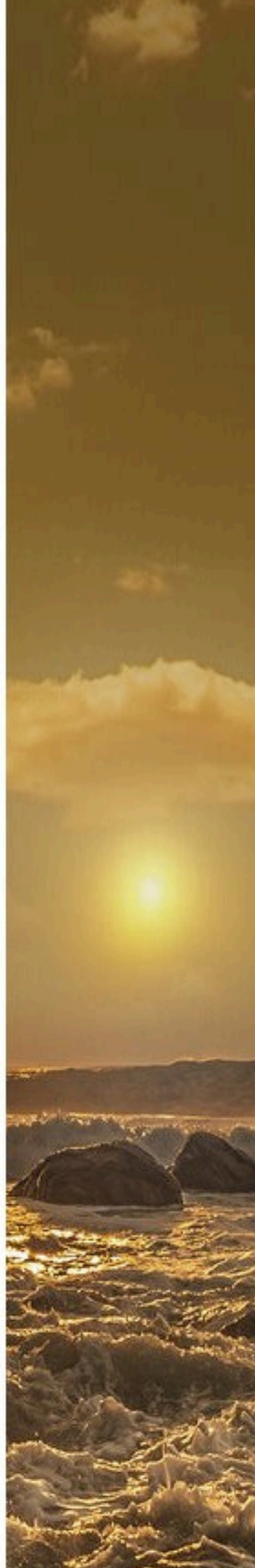
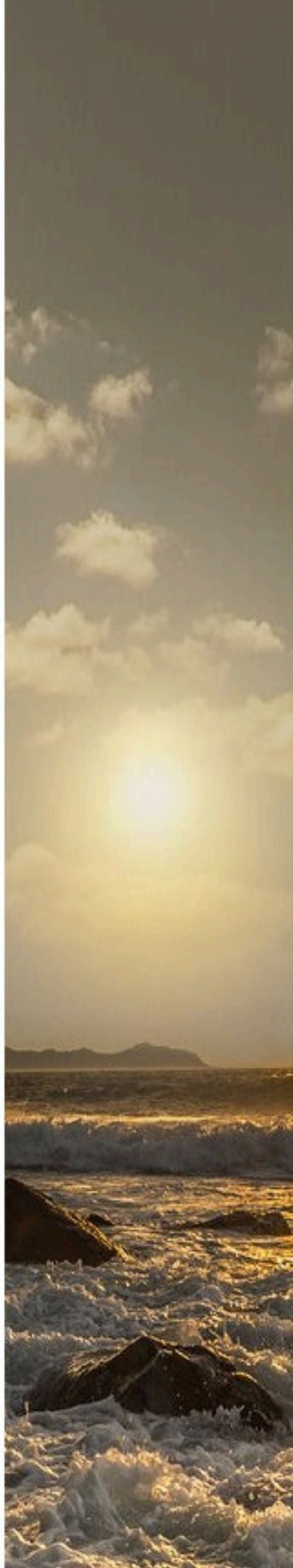
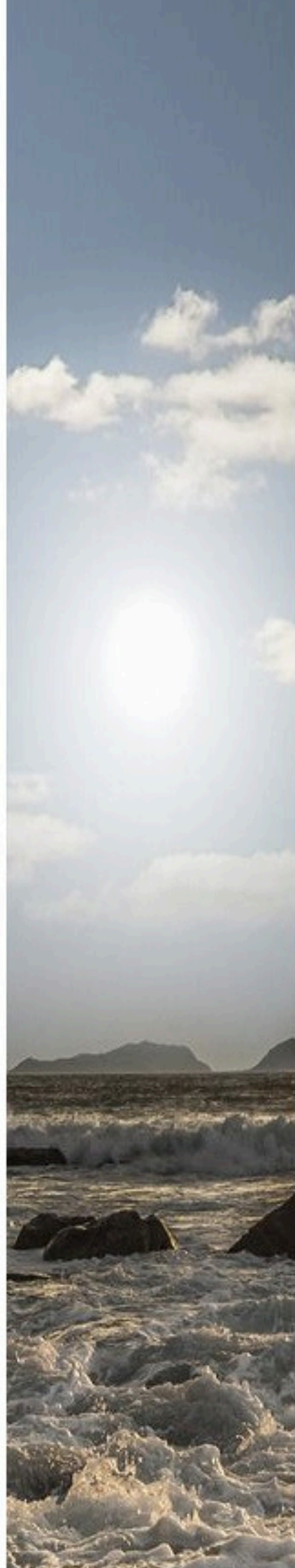
EN



HUMAN CENTRIC LIGHTING

onework GmbH
2026

Human Centric Lighting
in Health & Healthcare





Human Centric Lighting

HCL is an innovative lighting concept that is based on the natural circadian rhythms of humans and focuses on biological, emotional, and visual needs.

Unlike conventional lighting, HCL takes into account the non-visual effects of light through special ganglion cells in the retina (intrinsically photosensitive retinal ganglion cells - ipRGC), which contain the light-sensitive pigment melanopsin. These ipRGC cells are particularly sensitive to short-wave blue light and transmit information directly to the suprachiasmatic nucleus (SCN), the control center of the internal clock in the human body.

In hospitals, standard lighting concepts typically cause significant problems: during their stay, patients experience insufficient light exposure during the day and excessive artificial lighting at night, leading to a desynchronization of the circadian rhythm.

Translated with DeepL.com (free version)



Main benefits for patients

Improved sleep quality and increased sleep efficiency	page 06 - 07
Reduktion des Intensivstations-Delirs (ICU-Delir)	page 08 - 09
Reduction of intensive care unit delirium (ICU delirium)	page 10 - 11
Reduction in pain perception and pain medication	page 12 - 13
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Improved well-being and satisfaction	page 16 - 17
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Improved sleep quality and increased sleep efficiency

A groundbreaking study conducted at the cardiology unit of a New York university hospital (2021-2022) involving 87 patients showed that dynamic HCL systems bring about significant improvements in sleep parameters:

- Sleep prolongation: Patients in the HCL group showed a 66-minute increase in nighttime sleep duration (intervention group: 266 minutes vs. control group: 200 minutes, $p < 0.05$).
- Circadian phase shift: An advance of the
- rest/wake activity phase by 160 minutes was achieved.
- Sleep efficiency: A pilot study with depressed patients showed increased sleep efficiency of 92.59% under dynamic lighting vs. 90.18% under standard lighting ($p = 0.010$).

A recent meta-analysis of randomized trials suggests that melatonin can improve subjective sleep quality in critically ill patients (e.g., SMD 0.54; 95% confidence interval CI, 0.01-1.07).

Practical example:

A German university hospital intensive care unit reported a 31% improvement in patient sleep quality after one year of HCL implementation.

Reduction of intensive care unit delirium (ICU delirium)

This is one of the most significant advantages of HCL in intensive care units. A prospective, observational cohort study at a German university hospital (n=74) compared patients with multicomponent room design modifications (including dynamic lighting) to standard rooms:

- Significant reduction in delirium: 46% of patients in modified rooms developed delirium vs. 76% in standard rooms ($p = 0.017$)
- Delirium severity: Patients in standard rooms showed a 2.3-fold higher delirium severity (odds ratio = 2.292; 95% CI, 1.582-3.321; $p < 0.0001$)
- Melatonin influence: Light intensity, measured by “circadian effective irradiance,” significantly influenced melatonin levels ($p < 0.0001$)

A prospective pilot study (2022) showed that with a cyclical lighting system that mimics natural light across nine different automatically controlled scenes, patients showed a significantly higher average duration of deep, light, and total sleep, with lower respiratory rates in the intervention group.

Practical examples:

- German University Hospital: 26% reduction in ICU delirium
- A meta-analysis from 2025 shows that melatonin supplementation can reduce the incidence of delirium in critically ill patients (RR approximately 0.72; 95% confidence interval 0.58–0.89)



Faster recovery and shorter length of stay

A large retrospective analysis by the University of Michigan involving 85,021 hospitalized patients (38,788 with beds by the window; 46,233 with beds by the door) showed significant differences in length of stay (LOS):

- Reduced total length of stay: Patients near windows (more natural light) had shorter hospital stays than those near doors
- Confirmed after case matching (33,921 per group)

These findings are supported by several specific studies:

- Beauchemin & Hays: Depressed patients in bright wards: average LOS 2.6 days
- Beauchemin & Hays: Patients after myocardial infarction in bright rooms: LOS 3.7 days (average reduction compared to the control group)
- Kim (Korea): Bright light had a positive effect on resilience and reduced LOS

Practical example:

- German University Hospital Intensive Care Unit: 22% faster recovery after surgical procedures



Reduction in pain perception and pain medication

A classic randomized study involving patients who had undergone spinal surgery (Walch et al., 2005) is central here:

When exposed to more than 46% daylight:

- Patients reported significantly less pain and stress than in dark rooms.
- 22% less pain medication required.
- This led to a 21% cost saving in overall treatment.

Biological mechanism:

- The hormone serotonin is influenced by exposure to light and is linked to pain processing; there is also discussion that vitamin D synthesis through sunlight may play a role.

Practical implication:

- The faster recovery and reduced pain medication provided by HCL offers significant potential for opioid reduction measures in hospitals—particularly relevant given concerns about opioid dependence





Significant reduction in depression and anxiety disorders

A high-quality meta-analysis of systematic studies (2022) involving 7 randomized clinical trials (n=258 participants) showed that light therapy with high circadian stimulus (H-CS, CS > 0.1) significantly reduced depressive symptoms:

- Meta-analytic result: Mean difference (MD) = -5.56 (95% CI = -9.22 to -1.90, P = 0.003, I² = 64%)
- Optimal effectiveness: A circadian stimulus (CS) value > 0.57 showed better therapeutic results
- Comparison with antidepressants: Light therapy showed a faster effect than antidepressants (2 weeks vs. 4–6 weeks for seasonal affective disorder)

Stroke rehabilitation study (Rigshospitalet Glostrup):

A groundbreaking study involving stroke patients in a neurorehabilitation center showed the following results under natural lighting:

- Depression: 51.9% reduction in depressive mood
- Anxiety disorders: 28.6% reduction in anxiety disorders
- Well-being: 46.5% increase in general well-being

Dynamic lighting for depression (Denmark):

A study involving dynamic, geographically optimized evening lighting showed significantly fewer cases of depression and anxiety disorders among psychiatric patients, as well as an improved quality of life, compared to static lighting.



Improved well-being and satisfaction

Various studies document significant subjective improvements:

- Patients generally feel better and more satisfied.
- Reduced perception of the “hospital environment.”
- Emotional stress reduced by a more pleasant lighting atmosphere.

A study with blue-depleted night lighting showed:

- Hospital Anxiety and Depression Scale (HADS): Median 2-point improvement for both depression and anxiety disorders

This change was statistically significant.



Stabilization of the circadian rhythm

The circadian rhythm is central to all biological processes. In hospitalized patients, it is typically desynchronized. Melatonin and cortisol rhythms:

A study involving 76 ICU patients showed:

- Patients without delirium showed significant melatonin rhythmicity ($p < 0.001$).
- Patients with delirium showed no rhythmicity ($p = 0.064$).
- The MESOR (mean 24-hour melatonin) was significantly reduced in the delirium group ($p = 0.029$).

Rigshospitalet Glostrup Findings:

- Increased morning cortisol levels
- Increased melatonin levels
- Improved rhythmicity under natural lighting

These parameters are crucial for immune function and overall recovery. Correlations are well described in reviews on sleep, the circadian system, and the immune system.





Key benefits for medical staff

Better adaptation to shift work

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Increased attention in critical situations and reduced error rates

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Improving personal health despite shift work

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Improved satisfaction and working atmosphere

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Better adaptation to shift work

A study on circadian light therapy in shift workers (2024) showed:

- Better adaptation to night shifts thanks to optimized lighting conditions
- Reduced sleep disturbances despite inverted working hours

Practical effects:

- Less light-related downtime
- Improved sleep during daytime rest periods
- Lower physiological stress markers





Increased attentiveness in critical situations and reduced error rates

- Activating light with a high blue component during the day increases alertness and concentration.
- A 2024 study showed that employees under circadian light support had improved executive function and faster reaction times, with ~50% fewer lapses in concentration.

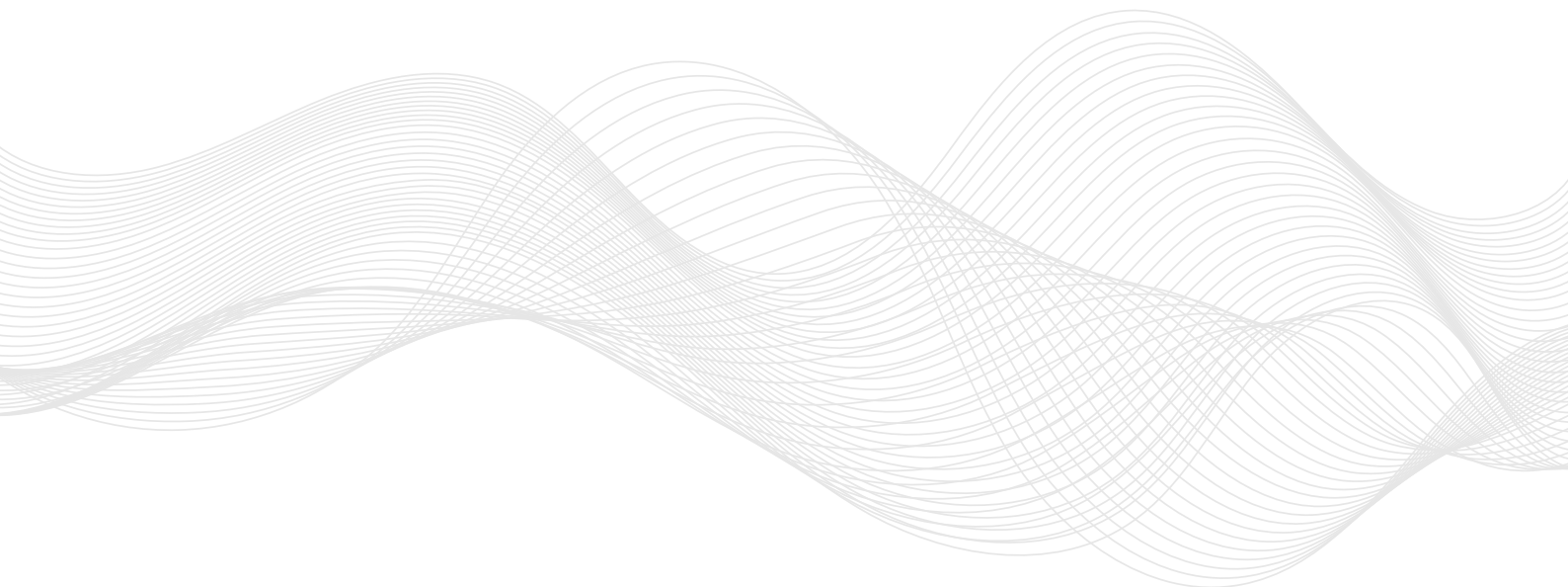
Special feature in the hospital:

- This is particularly valuable in intensive care units and operating rooms, where critical decisions are made. Reduced error rates in complex medical procedures have been documented.



Improving personal health despite shift work

- Stabilization of your own biorhythm despite irregular working hours
- Reduction of burnout and exhaustion
- Long-term improvement in cardiovascular health



Improved satisfaction and working atmosphere

A study conducted at the Rigshospitalet Neuroscience Clinic on employee satisfaction with HCL systems showed:

- Significant differences in satisfaction between standard lighting and HCL
- Staff appreciated the more natural lighting atmosphere, especially at night
- Warmer color temperature in the evening created a more calming environment
- Better suited to tasks such as blood sampling and blood pressure measurement
- Employees clearly preferred the zone-based control systems

Practical implications:

- Less use of penlights and cell phone flashlights
- Less eye strain due to better lighting conditions
- Increased emotional satisfaction at work





Benefits for specific patient groups

Geriatric and dementia patients

Older people lose sensitivity in their visual system as they age. Light transmission decreases and the internal clock becomes more easily disrupted.

Concrete improvements: Studies with dementia patients in nursing homes have shown that:

- Stabilization of disturbed day-night rhythms: Specifically for dementia patients whose rhythms are reversed due to their condition.
- Improved sleep quality: Up to 43% improvement in sleep quality.
- Reduction in nighttime restlessness: 38% reduction in a care facility.
- Fewer psychotropic drugs: Reduction in sleeping pills and sedatives
- Reduced fall rates: 15% fewer falls at night due to better orientation
- Increased daytime activity: Stabilized activity patterns during the day

Biological reason:

Older people need more light (at least 250 lux with at least 5,000 Kelvin in the morning-typical guideline) to stimulate their ipRGC cells.



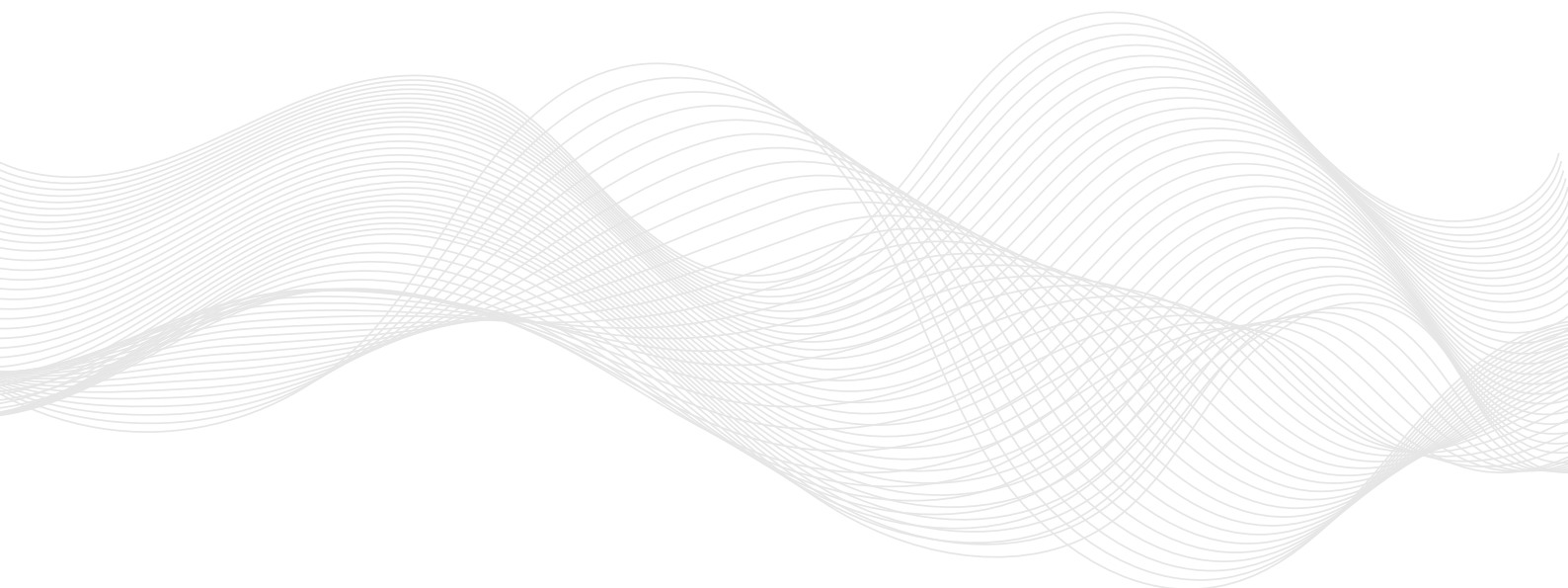


Additional benefits

Environmental and infection control: Reduction of hospital infections page 34 - 35

Positive effects on immune function & improvement of cognitive performance page 36 - 37

Cost and energy efficiency: Economic amortization page 38 - 39





Environmental and infection control: Reduction of hospital infections

Clinical and laboratory studies using 405 nm violet-blue light (high-intensity narrow spectrum, HINS) have reported, among other things, reductions in staphylococci of up to around 65% and lower surgical wound infection rates. This field of research is promising but still under development.

In isolation rooms:

- Staphylococcus reduction: 66.8% ($p = 0.0001$) under EDS HINS light
- In a second case: 38% reduction in the morning after system activation

In the operating room:

- Surgical site infection (SSI) rate reduced from 1.4% to 0.4% in an operating room equipped with violet-blue light systems (in 2,317 cases in period 2)

Laboratory tests:

- Exposure to 405 nm LED ceiling lights reduced CFU counts after 24 hours in all sampled areas.

Safety:

The radiation intensities were within safe international guidelines



Positive effects on immune function & improvement of cognitive performance

The circadian rhythm regulates the expression of immune genes and the activity of various immune cells.

During infections, circadian disturbances can be caused by proinflammatory cytokines. HCL helps to stabilize the rhythm.

- Rigshospitalet Glostrup: Improving cognitive function in stroke patients
- Reduced attention disorders through optimal lighting
- Better memory and reaction speed

These relationships are well described in reviews on sleep, the circadian system, and the immune system.

Cost and energy efficiency: Economic amortization

Indicative sample calculation (based on published studies and project experience)

cost reduction	payback period
Reduced sick leave (3-5% fewer light-related absences)	3-5 years
Shortened length of stay (1-2 years due to faster recovery)	1-2 years
Energy savings (demand-based, sensor-controlled lighting)	4-7 years

BAFA and BEG subsidy programs often reduce the payback period by a further 1–2 years.

Specific savings:

- 22% reduction in pain medication (Walch study)
- 21% total cost savings for pain patients





Implementation standards and guidelines

DIN SPEC 67600

German standards recommend the following parameters for HCL in hospitals

During the day (morning/mid-morning):

- Vertical illuminance: at least 250 lux at eye level
- Light color: at least 5,000 Kelvin (guideline value for activating daytime scenarios)
- Directly radiating luminaires (such as sky lights)

In the evening:

- Lower illuminance
- Maximum 3,000 Kelvin (warm tone)
- Indirect lighting

Night lighting:

- Blue-depleted systems for promoting sleep
- Needs-based activation via sensors

Note:

Specific values depending on room function and patient group are specified in the lighting plan



Summary

Human Centric Lighting in hospitals offers extensive, scientifically proven benefits:

For patients:

- Improved sleep quality (in studies, e.g., +66 minutes of sleep per night)
- Significant reduction in delirium (e.g., -30 percentage points in a prospective cohort study with multi-component ICU room design including dynamic lighting)
- Reduction in pain medication (-22%) and depression (-52%)
- Faster recovery and shorter length of stay
- Particularly significant for geriatric and dementia patients

For medical personnel:

- Better adaptation to shift work
- Increased alertness and reduced error rates
- Improved working atmosphere and satisfaction

For the hospital:

- Fast amortization (1-2 years through reduction in length of stay)
- Potential reduction in infections (in studies with 405 nm ambient light, staphylococci, for example, were reduced by up to ~65%; clinical relevance is being further investigated)
- Overall cost savings through reduction in medication

Successful projects start
with the right decision





We believe in working environments that are more than just functional-spaces that inspire, motivate, and invite people to linger. Our vision is to create places where technology works in the background but is noticeable in everyday life: through intelligent control, sustainable systems, and an atmosphere that focuses on people's well-being.



Solutions for your project



onework CORE

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onework LUX

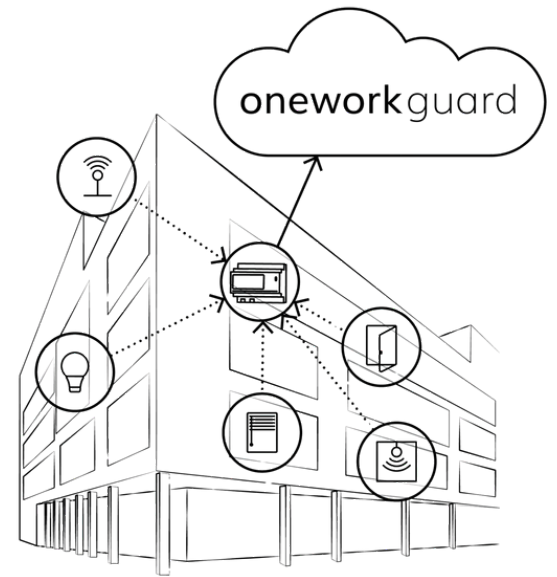
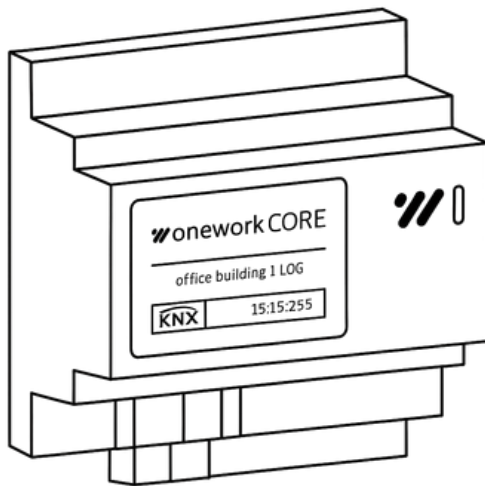
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onework TOUCH

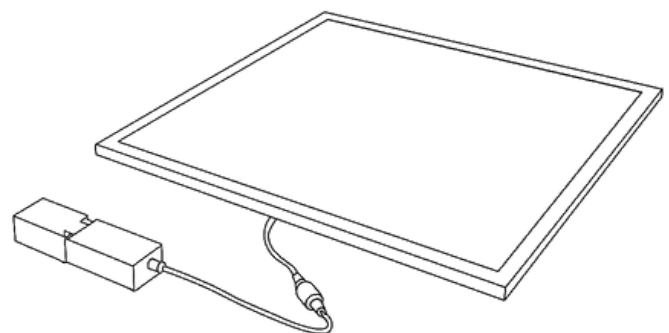
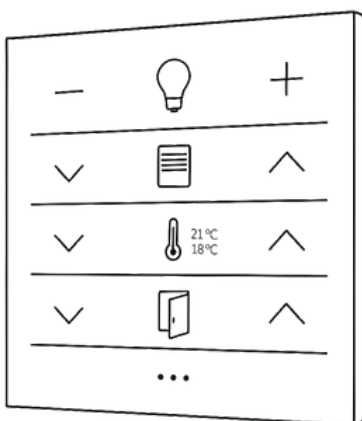
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onework GUARD

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Our
products
are your
foundation



onework CORE

The onework CORE automates lighting, climate control, air quality, and glare protection - for efficiency, comfort, and a healthy indoor climate.



With its cross-functional room automation, onework CORE improves the quality of stay and energy efficiency of commercial real estate. onework CORE is a certified KNX device. It integrates all devices and components available in the room into the automation of lighting, temperature, air quality, and glare protection. Communication with peripheral devices takes place exclusively via the KNX bus. Overriding the room automation systems, e.g., using our onework TOUCH, is possible at any time.

Maximum control, minimum effort

We believe in spaces that are more than just functional - that inspire, motivate, and invite people to linger. Our vision is to create places where technology works in the background but is noticeable in everyday life: through intelligent control, sustainable systems, and an atmosphere that focuses on people's well-being.

Certified KNX device. It integrates all devices and components available in the room into the automation systems for lighting, temperature, air quality, and glare protection.

Control of up to 30 rooms



Light

Intelligent lighting control that automatically adjusts brightness and color temperature to daylight, presence, and usage.

- Human Centric Lighting (HCL) for more productive working environments
- Tunable White for dynamic adjustment from cool to warm white
- Scene control for meetings, presentations, and workspaces



Temperature

Automatically optimizes heating and cooling systems. Saves energy through smart use of solar heat and occupancy data.

- Energy harvesting: Use of solar energy for passive heating
- Automatic adjustment to room occupancy and outside temperature
- Integration of blinds for effective summer heat protection



Air quality

Monitors CO₂, VOC, and humidity in real time. Automatically optimizes air quality—for better health and productivity.

- CO₂ & VOC monitoring for a healthy indoor climate
- Automatic window control for optimized fresh air supply
- Ventilation recommendations for manual air quality optimization



Glare protection

Automatically controls blinds and shutters based on sun position, weather, and room usage. Reduces glare and saves energy.

- Calculation of dynamic limit values based on theoretical brightness
- Stable positioning with fewer unnecessary movements
- Consideration of shading, reflections, and dynamic light behavior

onework LUX

With human-centric lighting, precise optics, and state-of-the-art LED technology, onework LUX creates light quality of the highest standard.

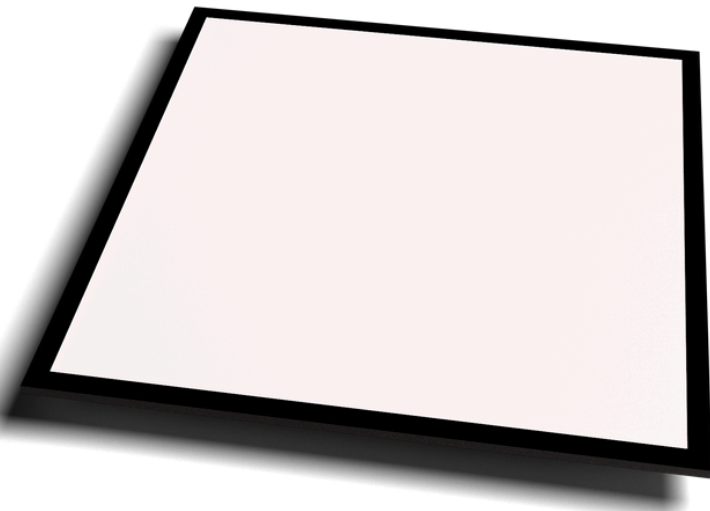


Stands for innovative lighting solutions that showcase both people and spaces. With state-of-the-art LED technology, clear design language, and maximum efficiency, our luminaires offer the highest level of lighting quality. Thanks to glare-free light distribution and precise optics, Onework LUX luminaires create uniform, pleasant illumination - perfectly tailored to the requirements of modern working and living environments.



Human Centric Lighting

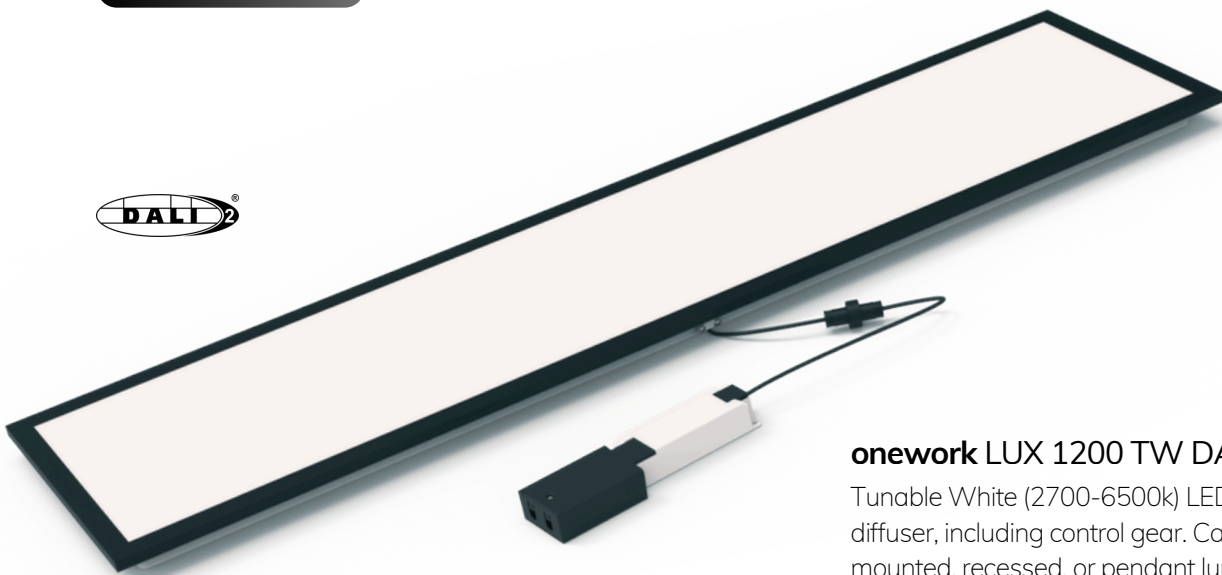
Light that can do more



onework LUX 600/625 TW DALI

Tunable White (2700-6500k) LED panel with prismatic diffuser, including control gear. Can be used as a surface-mounted, recessed, or pendant luminaire for system dimensions of 600mm x 600mm or 625mm x 625mm.

Available in
black and white



onework LUX 1200 TW DALI

Tunable White (2700-6500k) LED panel with prismatic diffuser, including control gear. Can be used as a surface-mounted, recessed, or pendant luminaire for the system dimensions 1200mm x 300mm.

Available in
black and white

DALI - dimmable

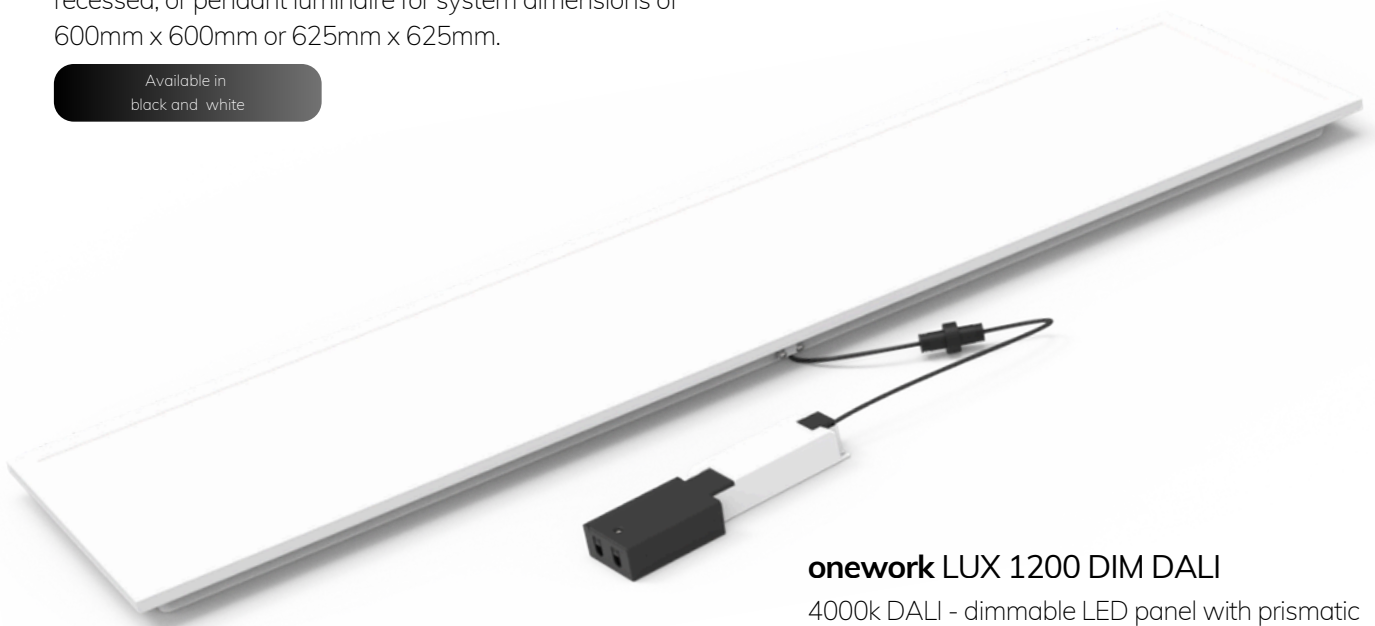
More control, more comfort



onework LUX 600/625 DIM DALI

4000k DALI - dimmable LED panel with prismatic diffuser, including control gear. Can be used as a surface-mounted, recessed, or pendant luminaire for system dimensions of 600mm x 600mm or 625mm x 625mm.

Available in
black and white



onework LUX 1200 DIM DALI

4000k DALI - dimmable LED panel with prismatic diffuser, including control gear. Can be used as a surface-mounted, recessed, or pendant luminaire for the system dimensions 1200mm x 300mm.

Available in
black and white



onework LUX TL TW DALI

Tunable White (2700-6500k) LED spotlight, incl. control gear. Can be used in track lighting systems.
Beam angle: 15°, 24°, 60°

Available in
black and white



Tunable White Tracklights

Dynamic lighting, precision on the track



onework LUX TL P TW DALI

Tunable White (2700-6500k) LED projection spotlight, incl. control gear. Can be used in track lighting systems. Beam angle: 45°

Available in
black and white





Linear light Clarity that makes an impact



onework LUX LL 1200 TW DALI

Tunable White (2700-6500k) pendant light, incl. control gear. For optimal lighting conditions, system dimensions: 1200mm x 70mm x 70mm.

Available in
black and white

Downlights

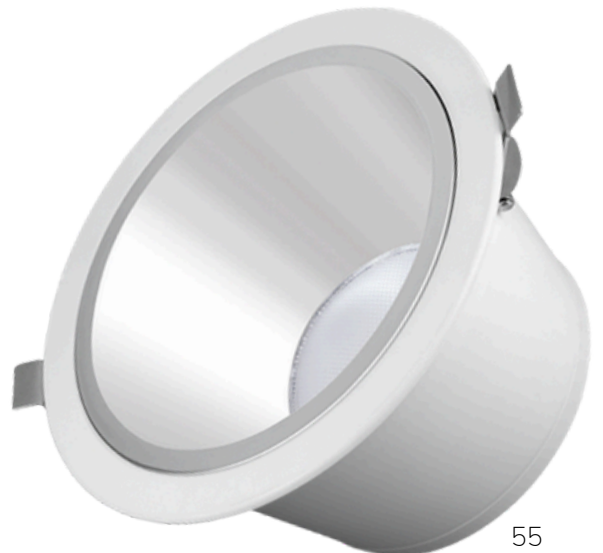
Discreetly powerful, visibly effective



onework LUX DL 180 TW DALI

Tunable White (2700-6500k) downlight with prismatic diffuser, including control gear. Can be used as a recessed luminaire for the system dimensions 180mm x 92mm.

Available in
black and white



onework TOUCH

The intuitive 4-inch onework TOUCH control panel combines lighting, climate, shading, and scene control in one elegant interface.



The onework TOUCH is a 4-inch touch display for intuitive and efficient building control. Developed for seamless integration into KNX systems, it combines modern design with the familiar operation of a classic push button. Thanks to its customizable user interface, the onework TOUCH enables precise control of lighting, shading, climate, and scenes - all with a single touch.

Everything under control With just one touch

onework TOUCH

onework TOUCH is a modern touch control panel that brings together all room control functions on a single, intuitive user interface. Whether lighting, temperature, air quality, shading, or individual scenes - all relevant functions can be intelligently controlled with just a few touches.



Full KNX compatibility

Manufacturer-independent and flexible for use in any KNX environment.



Intuitive operation

Button-based interface for maximum user-friendliness - no adjustment necessary.



Versatile control

Lighting, blinds/shutters, windows, temperature, and scenes with just one tap.



Advanced features

Automatic/manual detection, window instructions, and intelligent automation with onework CORE.

onework GUARD

The cloud-based fault reporting management system onework GUARD detects errors in real time, analyzes causes, and provides proactive recommendations for action.



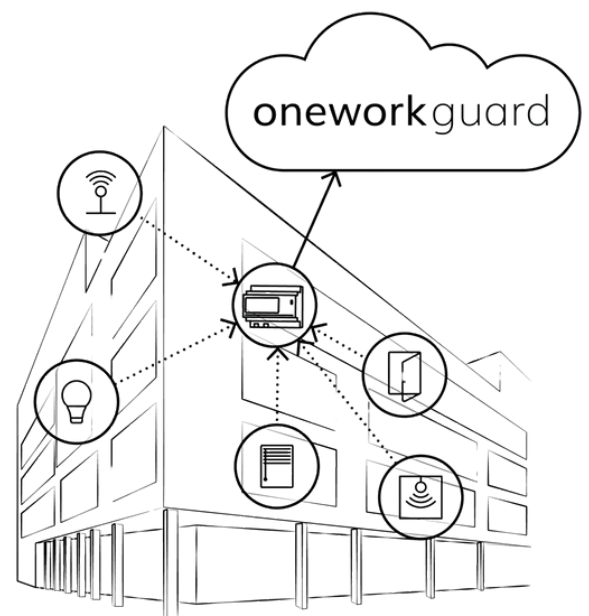
The development of onework GUARD is funded as an innovation project called guard building management system (guard BMS) as part of the Schleswig-Holstein state program Economy 2021–2027 (LPW 2021) and proportionally by the European Regional Development Fund (ERDF). The aim of the project is to create a cloud-based, manufacturer-independent building management system for KNX-based commercial properties that uses a digital twin and AI-supported algorithms to detect errors in real time, analyze causes, and provide proactive instructions for rectification. The system is complemented by the ETS app “Project Health Check,” which automatically avoids configuration errors in KNX projects. This innovation reduces operating costs, increases energy efficiency, and improves the quality of stay - a future-proof milestone for modern buildings.

Fully protected, monitored at all times, always one step ahead

onework GUARD

onework GUARD, the digital twin of the building infrastructure, is a cloud-based fault reporting management system for KNX bus systems. It enables demand-oriented monitoring of devices and data points. Alarm rules can be predefined and individually configured. Alarms and their effects are clearly displayed and system statuses are vividly visualized.

SaaS



Visualize system states



Define custom alarm rules



Aggregation of sensor data



Processing of alarm and status messages



Monitor devices and data points



Analyze malfunctions and make recommendations



Automatic error analysis



building
better
workplaces
together



Standards and literature

DIN EN 12464-1 Light and lighting –

Lighting of workplaces, Part 1: Indoor workplaces

The following standards are relevant to the workplace:

DIN EN 12464-2 Light and lighting –

Lighting of workplaces, Part 2: Outdoor workplaces

DIN 5035-7 Lighting with artificial light –

Part 7: Lighting of rooms with computer workstations

DIN EN 12665 Light and lighting

Basic terms and criteria for defining lighting requirements

DIN V 18599 Energy assessment of

buildings – calculation of useful, final, and primary energy demand for heating, cooling, ventilation, domestic hot water, and lighting

DIN 5035-7 Lighting with artificial light –

Part 7: Lighting of rooms with computer workstations

DIN SPEC 5031-100 Radiation physics in the optical range and lighting technology –

Part 100: Non-visual effects of light on humans mediated by the eye – Quantities, symbols, and effective spectra

DIN SPEC 67600 Biologically effective lighting –

planning recommendations. This document provides planning recommendations for living spaces that may be workplaces or non-workplaces. It also includes areas where uses may overlap or mix..

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(Randomized studies on naturalistic light in stroke rehabilitation (Rigshospitalet Glostrup)

Meta-analysis of melatonin in intensive care medicine (delirium incidence, sleep quality; Crit Care Med or comparable journals, 2024/2025)

Studies on 405 nm environmental disinfection (violet-blue light/HINS light) with staphylococcus reduction and SSI reduction

DIN SPEC 67600 (2013) - Biologically effective lighting... DIN German Institute for Standardization



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