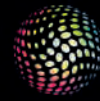


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December 2021



TRILUX
SIMPLIFY YOUR LIGHT.

LIVELINK APPLICATIONS

SOLUTIONS FOR
PARKING FACILITIES

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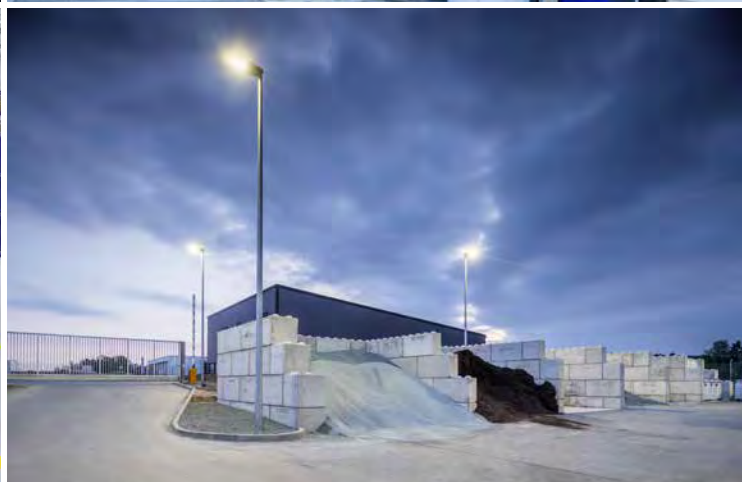


Contents

TRILUX	2
Simplify Your Light	2
Smart Solutions	4
Services	6
Made by TRILUX	8
Introduction	10
Overview of the systems used	11
Applications	12
Refurbishment professionals	12
Parking deck with HFS light management	12
Parking deck with LiveLink SwarmSens	14
Parking deck with LiveLink WiFi+ RC	16
Cleverly controlled	18
Parking deck with LiveLink WiFi	18
Sensors for the LiveLink systems	21
Fully integrated	22
Parking deck with LiveLink Premium	22
In ancillary areas	24
Stairwells with HFS light management	24
Contacts	26

TRILUX

SIMPLIFY YOUR LIGHT





TRILUX SIMPLIFY YOUR LIGHT represents the simplest and most reliable path to customised, energy-efficient and future-proof lighting solutions. In the dynamic and ever increasingly complex lighting market, customers are provided with optimal advice, ideal orientation and perfect light. To ensure this, TRILUX offers a wide portfolio of technologies and services as well as high-performance partners and companies in the TRILUX Group. The lighting specialist combines single components to create custom-designed complete solutions – always perfectly tailored to the customer's requirements and specific applications.

In this way, complex and extensive projects can be simply and rapidly implemented from a single supplier. In the spirit of SIMPLIFY YOUR LIGHT, simple planning, installation and ease of use is focused on for customers in addition to quality and efficiency.

www.trilux.com

SMART SOLUTIONS

LIGHTING NETWORKS
AS INFRASTRUCTURE

Digitalisation starts with lighting

You want to advance digitalisation in your company by a huge step, with minimum effort and risk? Start with lighting! Networked lighting not only provides enormous improvements regarding energy efficiency, comfort and intelligence. The light points' power supply can also be used for non-lighting applications. This way, the lighting network creates the perfect infrastructure for innovative applications.

TRILUX supports companies in their digital transformation with a three-step approach. The degree of networking and lighting intelligence can be adapted precisely to individual requirements and framework conditions. Each step brings more opportunities – and larger improvements.

FUTURE-SAFE

HEAT MAPPING

DIGITAL TRANSFORMATION

SMART SOLUTIONS



Simple LED transformation – but with DALI, please

Simply converting to LED lighting already improves energy efficiency and quality of light significantly. In terms of technology, companies can choose between switchable LEDs and dimmable, DALI-based LEDs. TRILUX recommends DALI luminaires, since the DALI protocol has become established as the standard for controlling luminaires and lighting networks. This provides maximum future-safety. DALI luminaires can also be networked and functionally upgraded at a later time without difficulty – and thus form the basis for all further transformation steps.

Networking – individual light points form an intelligent lighting network

With the LiveLink light management system, DALI luminaires can be connected quickly and simply to form an intelligent network. This opens up entirely new possibilities regarding luminaire control, analysis and optimisation. Sensors for presence detection and constant light control on request minimise energy consumption, and sophisticated, automated light scenes like Human Centric Lighting bring daylight into buildings. The next step leads to the cloud: with TRILUX Monitoring Services, companies can e.g. monitor, analyse and optimise operating data for any individual luminaire in real time via the LiveLink Cloud. This way, maintenance cycles can be adapted to actual requirements. This reduces costs as well as the risk of surprising lighting maintenance needs (predictive maintenance).

ASSET TRACKING

CONNECTIVITY

INTERNET OF THINGS

2

3

AUTONOMOUS VALUE CHAIN

More than just light – lighting networks as infrastructure

Lighting networks across entire buildings create the perfect infrastructure for innovative applications and networking processes. TRILUX DALI luminaires are IoT-ready and can be flexibly connected with Smart Solution components (even retroactively). This also facilitates location-based services such as asset tracking and heat mapping. And there is more: multi-sensor systems, which can be integrated into the lighting network, can seamlessly transfer their data to superordinate building automation systems. Light points become data nodes for building management and Smart Solution applications and thus accelerate digitalisation in companies.

SERVICES

FULL SERVICE FOR YOUR PROJECT



TECHNICAL SERVICES

Technical Services from TRILUX – We'll take care of that for you!

Things have never been simpler. With Technical Services from TRILUX, you can put all the tasks regarding your new lighting installation in the hands of TRILUX and our partner network – starting with disassembly and correct disposal of the obsolete system all the way to the installation of the new system in cooperation with our partners. On request, our experts will also take care of networking as well as programming and commissioning of the LiveLink light management system for you.



PROJECT MANAGEMENT

Coordination of large projects to help lighten the customer's workload

Today's modern buildings must be intelligent, sustainable and flexibly usable – and perfectly adaptable to individual customer requirements and conditions.

- Full-service principle for the customer:
TRILUX acts as a general contractor with all lighting issues.
- Implementation of all coordination tasks by TRILUX Project Management:
ranging from consulting and lighting design, the integration of various lighting-related systems such as indoor, outdoor and emergency lighting, light management including sensor technology, distribution, supply, mounting, installation and maintenance.



FINANCING

Various possibilities, extensive advice

LED renting or purchase, hire purchase or leasing?
Together with you we draw up your ideal financing solution.

- Balance-neutral realisation of lighting projects without own investments:
greater scope for action by protecting the equity capital.
- Cost-covering for a new lighting solution often from the first day by reducing operating costs.
- Pay per Use – the all-round carefree package
Everything from a single source: TRILUX plans and installs a custom, state-of-the-art lighting solution. You only pay a monthly rate for using the installation, which consists of a fixed portion as well as a consumption-based service fee. In addition to installation and financing, the price also includes system monitoring with the Monitoring Services.



DIGITAL SERVICES

Lots of added value with minimal effort

Digitalisation opens up numerous possibilities regarding your lighting solution, from high-performance data monitoring all the way to IoT services. Ideal conditions for reducing costs and significantly increasing transparency as well as convenience. With TRILUX Digital Services, you can exploit the potential of a modern lighting solution – quickly, securely and without effort and risk. Networking and connecting the luminaires to the cloud is achieved simply via plug & play via the LiveLink light management system. The option to integrate further sensor systems turns the lighting network into a technology carrier with great potential and benefit.

Energy and Light Monitoring: full control of the entire lighting system

With the monitoring services, you gain access to all relevant operating data of the lighting solution via LiveLink. In addition to the optimisation of energy consumption, maintenance cycles can also be adapted to genuine requirements because the system detects the need for maintenance in advance. This predictive maintenance is significantly less complex and therefore also more economical than fixed maintenance intervals.

Monitoring services supply data on:

- Dimming and operating status (on or off)
- Energy consumption and operating duration
- Error notifications and temperature of the ECG
- Predictive maintenance

Location Based Services: the next level for your business

Determining the position of persons or objects offers you optimisation potential which leads to cost reductions and increases in sales. Location-based services enable new relevant customer benefits by integrating Bluetooth transmitters into the luminaires:

- Reduced search and setup times through asset tracking
- More targeted positioning of merchandise through knowledge of customer movements in the retail sector
- Opening up of new communication channels via push messages directly to your customers' smartphone



PAY PER USE – THE COMBINED SERVICE MODEL

The simplest way to your luminaire upgrade

With the Pay per use financing model, TRILUX offers a flexible option for obtaining an energy-efficient LED lighting solution without tying up capital. This approach makes it possible for companies to finance the new lighting installation through a monthly, consumption-based rate: this way, they remain flexible and preserve investment leeway for their core business. The usage-based portion of the monthly costs is only due if the system is actually being used. If the installation is switched off, e.g. on bank holidays or weekends, only the base rate becomes due.

Furthermore, the new LED lighting systems generate significant savings in terms of energy and maintenance costs. From the very first month, savings of up to 80% compared to the obsolete system are possible. Subtracting the expenses for the monthly base rate, there is still an overall cost reduction of up to 20%.

In addition, the installation of the new lighting system as well as the disassembly and correct disposal of the obsolete system are included in the TRILUX Pay per use scope of services. Via predictive maintenance, systems can be monitored and corresponding maintenance intervals can be planned without difficulty. This prevents disruptions in operation and expensive downtimes.

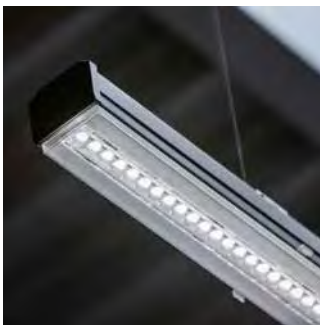
QUALITY

MADE BY TRILUX



German engineering, customised solutions and innovative design – this all indicates “Made by TRILUX”.

The German market leader for technical light traditionally places great importance on high-class workmanship and products with maximum quality that can be flexibly adapted to individual user needs and conditions. TRILUX offers not only standard solutions, but in close cooperation with customers also develops tailored lighting concepts. These solutions comply with all standard requirements and score points in terms of function as well as ambiance. High-quality materials, optics developed in-house, pioneering lighting technology and a research and development department which continuously and consistently seeks optimisation potential at all levels – “Made by TRILUX” is the guarantee for the highest level of quality across the board.



Product quality

TRILUX stands for customer-specific configurations and develops products with and for its customers oriented precisely to their needs. TRILUX offers market-compliant and future-proof lighting solutions matched to the specific requirements of the various applications.



Design quality

TRILUX lighting concepts adapt to the overall architectural concept of a building. It is a matter of complementing the architecture with good lighting. We develop our products in close cooperation with renowned lighting designers, and such products are regularly awarded design prizes.



Light quality

TRILUX lighting solutions offer much more than just standard compliant lighting. They can be adapted individually to very different needs, supporting users in their daily work tasks.



Data quality

TRILUX accompanies and drives forward this transformation in the planning of building constructions with BIM by providing extensive product documentation. Such documentation leads the way in the industry.



Introduction

Application-oriented light management can significantly support compliance with the requirements for modern lighting installations. In the case of lighting for parking structures, the focus is on quality of light and energy efficiency.

The basis for the examples in the following compilation is a large parking deck, which is to be assumed as the lowest parking deck of an underground car park (one entrance downward and one exit upward)¹. On the parking deck, luminaires of the Aragon Fit series with extremely wide light distribution specially developed for multi-storey car parks provide uniform lighting right up to the peripheral areas. High vertical illuminance levels result in good perceptibility of people and faces. In addition, a transparent luminaire body was selected. Spatial perception and glare reduction benefit from the indirect light component, which creates a luminance in the immediate vicinity of the mounting surface.

Four solutions with different light management systems will be presented one after the other. They are intended to illustrate the specific performance characteristics of the respective system using examples. The compact presentation, partly in keyword form, provides orientation for the situation in question and facilitates a comparison of the examples.

With no persons present, a basic light level is maintained in all four cases considered, which continues to ensure orientation in the room and a safe view of more distant areas.

Long operating times result in a high potential for energy savings in a light management system of this kind. Many parking garages are open year-round (8,760 h/a).

For a detailed picture of the technical interrelationships, the technical documentation of the luminaires and light management systems should be consulted.

¹The floor plan is used to show the lighting functions. Structural periphery conditions are not explicitly considered.

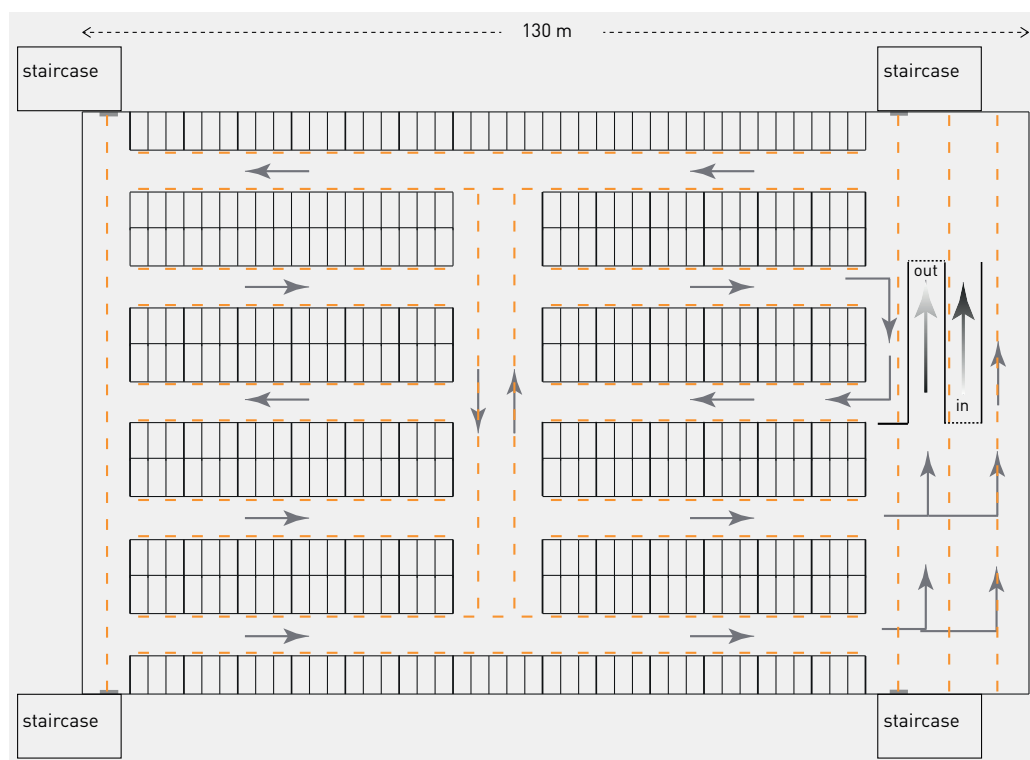


Figure 1:



parking deck on the lowest floor of an underground car park (one entrance and one exit). 372 luminaires with extremely wide light distribution with indirect component for uniform and glare-free illumination of parking bays and driveways.

The floor plan shown serves as the basis for the comparison of example configurations of different light management systems on the following pages.

Overview of the systems used

	HFSB/X	LiveLink SwarmSens	LiveLink WiFi	LiveLink WiFi + RC	LiveLink Premium
Presence detection	X	X	X	X	X
Basic light	X	X	X	X	X
Leading light	X	-	-	-	-
Zoning	-	X	X	X	X
Daylight use	X	X	X	X	X
Daylight-dependent control	-	-	X	X	X
Threshold switch	X	X	-	-	-
Installation					
plug and play	X	X	-	-	-
Control units integrated in luminaires	X	X	X	X	-
Sensors integrated in luminaires	X	X	-	-	-
Control unit for cap rail installation	-	-	X	-	X
Other functions					
Monitoring	-	-	X	X	X
Building interface (KNX, BACnet)	-	-	-	-	X

All technical data including dimensional and weight specifications have been checked carefully. Errors excepted. Possible colour deviations are due to printing processes. We reserve the right to modify in the interest of progress. Luminaires are partly shown with accessories that must be ordered separately. Images of installations may show custom manufactured luminaires.



Application:

With the HFSB/X system used here, the parking areas are only illuminated when someone is present and also only in a limited field. Switching is carried out fully automatically in the course of the driveway. The illuminated field extends around the motion-detecting sensor to the next sensor in both directions of the luminaire row (leading light). The travel paths can be switched as an overall group if required (see figures 3 and

4). The return to basic light takes place after the delay time settable during commissioning.

The sensor technology is fully integrated into the luminaires and is not visible to the users of the parking garage.

In addition to energy savings, reduced lighting operation also leads to a significant increase in the service life of the LED luminaires.

Installation:

For the controlled operation of a luminaire arrangement, a sensor luminaire ...HFSB and further sensor luminaires ...HFSX are required (see also [product information](#)).

The HFSB luminaire is installed as the first sensor luminaire in the row arrangement. The respective spacing of the subsequent HFSX luminaires must be set up in such a way that complete presence detection is ensured. Up to 14 DALI luminaires can be placed between two sensor luminaires as required.

All luminaires in the arrangement are connected with a 5-core line for power supply and control. The HFSB and HFSX sensor luminaires are equipped with system connections on both sides for this purpose. The following should be taken into account.

- HFSB luminaires:

- Equipped with plug socket (output) on both sides.
- Sensor luminaire forms a DALI system with max. 15 DALI devices with DALI luminaires connected at both ends.

- HFSX luminaires:

- Equipped with plug (input) and socket (output).
- The plug (input) points to the HFSB luminaire at the beginning of the luminaire row.
- The control unit input receives a signal from the previous sensor luminaire's output.
- The control unit sends control signals at the output (plug socket).
- The sensor luminaire forms a DALI system with max. 15 DALI devices with DALI luminaires connected at the output.
- The row arrangement is continued only in one direction (at one output of the HFSB luminaires).
- An HFSX luminaire (input) may only be connected to the output (DALI control) of one previous sensor luminaire (splitting of the luminaire row).
- The number of sensor luminaires in an arrangement is limited to max. 40.

A possible constellation for the implementation of the light management functionality described under "Application" on the given parking deck is shown in figures 2 to 4 .

Commissioning

The commissioning of the light management systems of the parking deck can be carried out in a few minutes with the help of the IR remote control (see also [product information](#)).

- Commissioning is carried out for each row of luminaires. The settings are made at any sensor luminaire in the arrangement.
- The light level for presence (depending on the design, generally 100%) and the basic light level (20%) are set.

- For the arrangements in the parking bay aisles, the group behaviour "swarm" is set for the leading light with a 5-minute switch-off delay.
- If necessary, "all" can be set for switching the entire system with a switch-off delay of 2 minutes for the luminaires of the crossways and the entry/exit (see also figure 3).
- With "send all", the settings are transmitted to all sensor luminaires in an arrangement.

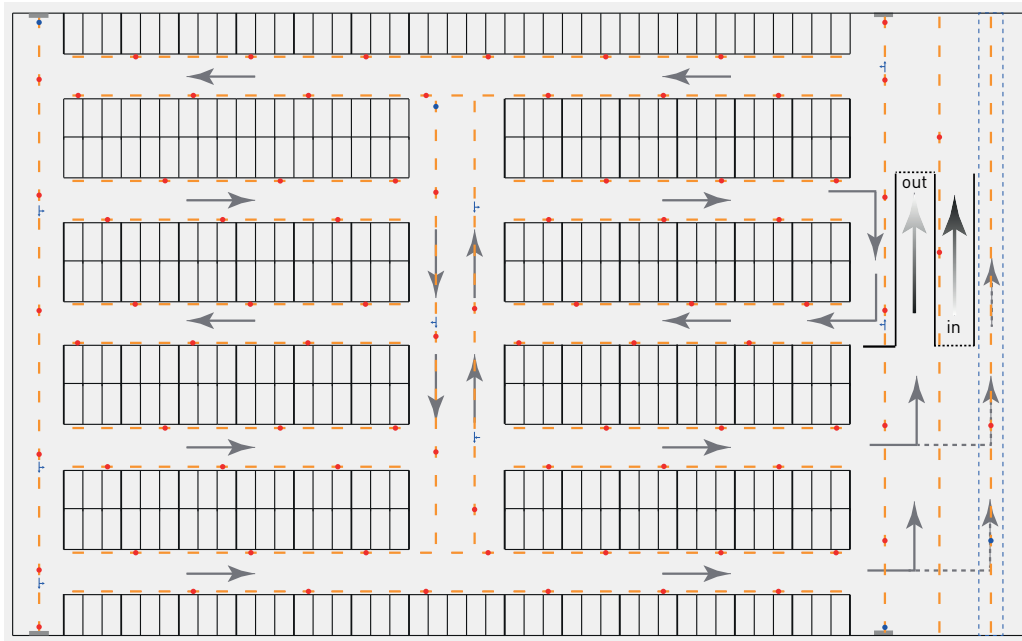


Figure 2:

Parking deck with 86 HFSB/X sensor luminaires and another 286 DALI luminaires in parking bay aisles and crossways:

- Sensors close to stairwell doors.
- HFSB sensor luminaire at the beginning of a possibly branched continuous line.
- Parking bay aisles in the direction of travel:
 - Control at the entrance by branching from the crossway (↑).
 - Control ends at the next crossway.
- Arrangement of sensors with (almost) overlapping detection areas.
- Leading light ("swarm") in the parking bay areas.

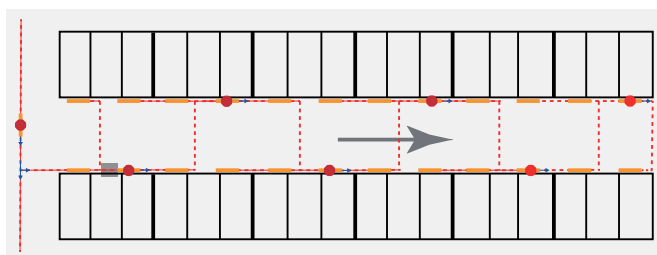


Figure 3:

Wiring for leading light in a parking bay aisle. Two (four) luminaires at the beginning of the row are connected to the output (→) of the upstream sensor luminaire in the approaching crossway (↑). A sensor luminaire forms the end of a luminaire row. If crossways or parking bay aisles are to be operated as groups ("all"), the connection from the crossway to the first sensor luminaire of the parking bay aisle must be interrupted.

- HFSX-Sensor luminaire

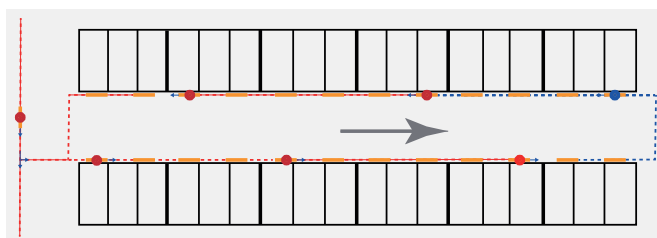
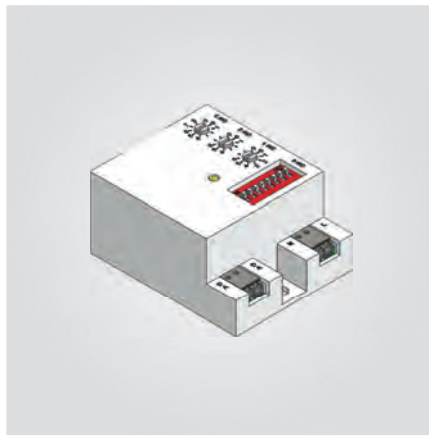


Figure 4:

Alternative wiring for leading light on a driveway when routing the cable across the driveway is difficult for structural reasons. A sensor displayed in blue indicates the HFSB sensor luminaire at the end of the parking bay aisle. A row of luminaires connected in the opposite direction begins here.

- HFSB-Sensorleuchte
- HFSX-Sensorleuchte

The two inner rows of luminaires in the entrance and exit area are wired as a coherent arrangement like a parking bay aisle (see figure 3). The outer row of luminaires (far right, framed in dashed lines) forms a separate arrangement.



Application:

The LiveLink SwarmSens system used here enables the lighting to be controlled on the basis of a radio network. This makes it particularly suitable for refurbishments where structural conditions prevent the luminaires from being connected to control lines.

With regard to lighting, the parking deck is divided into individual driveway and parking areas, which are always illuminated with at least one basic light ². When motion is detected, the light level for the area in question is increased to full operation. The luminaires are controlled fully automatically in independent groups. The return to basic light takes place after the delay time set during commissioning.

In all areas, the detection of the entry of vehicles is securely ensured. In areas with parking bays and footpaths, equipping every second luminaire with a sensor ensures that movement is detected over almost the entire area. Even with short switch-off delays, which result in high energy savings, lighting is ensured at all times while people are present. Some of the driveways and parking bay aisles are divided into sub-areas with separate groups of luminaires to further increase the energy-saving potential (see figure 5).

The sensor technology is fully integrated into the luminaires and is not visible to the users of the parking garage.

In addition to energy savings, reduced lighting operation also leads to a significant increase in the service life of the LED luminaires.

Installation and parameterisation:

All luminaires of the LiveLink SwarmSens system are equipped with a radio network module to enable controlled operation of luminaires that are not interconnected by a control line.

Each group must contain at least one so-called master luminaire (AragonFit...+ DMM) with radio network module and integrated sensor. When presence is detected, it sends a switch-on signal to the network. Additional master luminaires can be added to improve presence detection.

If fewer sensors than luminaires are required, the luminaire group can be supplemented with additional network luminaires (AragonFit...+ DMR).

All network luminaires (...+ DMM, ... + DMR) can forward a received signal. This way, the signal is passed from luminaire to luminaire (mesh network). For safe signal transmission, luminaires must be arranged to have each luminaire within transmission range of at least one neighbouring luminaire of the same luminaire group.

If required, the DLiveLink SwarmSens system also makes it possible to set up threshold switching dependent on the ambient brightness to prevent the lighting from switching on when there is sufficient daylight.

The radio network module is integrated in the luminaire in such a way that its operating elements are freely accessible when the luminaire cover is open. It is therefore advisable to make the settings required for the later desired operation directly after installation and before closing the luminaire.

Light control settings are made on each luminaire using three rotary switches and a row of DIP switches (see illustration above):

- **Sensitivity of motion detection** at rotary switch SW3: level 9, for maximum sensitivity.
- **Switch-off delay** at rotary switch SW2: level 2, five minutes.
- **Threshold switching** at rotary switch SW1: level 0, light sensor deactivated.
- **Signal Forwarding** (repeater mode) activated: DIP-Schalter 1, ON.
- **Basic light** activated: DIP switch 2, ON (this setting is only required on one sensor luminaire DMS per group).
- **Group setting** with DIP switches 3 to 8 (6 bit, 64 addresses): same setting for all DMS and DMR luminaires of a group in one area to be illuminated.

If threshold switching is to be set up in an area with daylight, the threshold illuminance in the area of a master luminaire must be provided in order to determine the required setting of rotary switch SW1 on this master luminaire ³. This value must

²The basic light provides 10 % of the luminous flux at full operation. If required, a different value can be factory-preset.

³The setting of the rotary switch depends on the desired threshold value and the ambient conditions, such as the reflectance of the detected surfaces.

then be set on all master luminaires. If the set threshold value of the brightness in the detection range of a master luminaire is exceeded when the lighting is switched off, the lighting is not switched on even if movement is detected by this master

luminaire. However, as soon as movement is detected by a master luminaire in a sub-area with insufficient brightness, the luminaire automatically switches on the lighting.

Commissioning

It is recommended to commission the luminaires before closing the covers. A full test of all desired functions of the entire lighting installation should be performed at this time. Any adjustment or correction of the parameterisation of the luminaires can be carried out with little effort if required. One possible approach:

- **Grouping test:**
 - A test person enters each individual area of a luminaire group to verify whether all luminaires within the area and no luminaires outside of the area are switched on.
 - If necessary, correct the group setting at DIP switches 3 to 8 and repeat the test.
- **Detection test:**
 - Enter each control area from both sides to test the sensitivity of the detection.
- In the middle of subdivided driveways and parking bay aisles, the maximum sensitivity of detection should be maintained to avoid entering dark zones.
- At the ends of driveways and parking bay aisles, the sensitivity of detection can be reduced, if necessary, to the extent that vehicles passing on an adjacent cross walk do not trigger full operation of the area's lighting.
- **Switch-off delay test:**
 - Check all areas to verify whether the identical switch position on rotary switch SW2 is set for the correct switch-off delay on all master luminaires.
 - To do this, enter the area and then leave it for the period of the switch-off delay.
 - The luminaires in the group should switch off individually after approximately the time of the selected switch-off delay.⁴
 - If necessary, the setting on the master luminaires in question must be corrected.

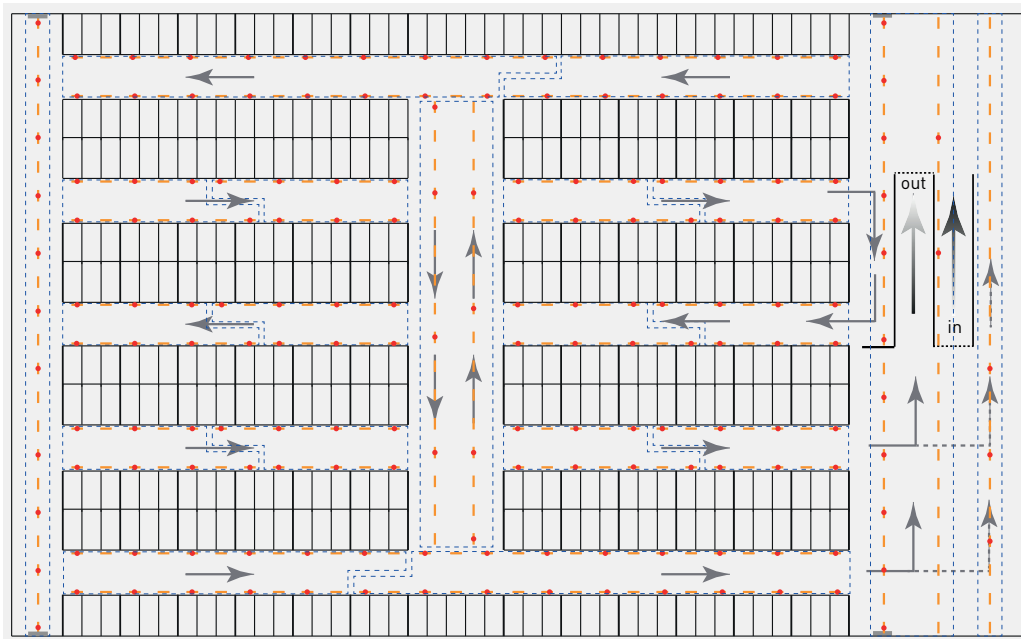


Figure 5:

Parking deck with 175 master luminaires with integrated sensor and 197 receiver luminaires in LiveLink Swarm-Sens radio network in parking bay aisles and crossways:

- Sensor luminaires close to stairwell doors.
- Parking bay aisles:
 - Full operation when entering by car or on foot or staying in the area of the luminaire group.
 - Sensor sensitivity adjustable. Where required, it is possible to avoid switching on full operation when vehicles pass on crossways.
- Arrangement of sensor luminaires with (almost) overlapping detection areas.

⁴Each luminaire in the network has an internal timer. Master luminaires send switch-on signals including hold times. Hold times are overwritten. The last received hold time is valid.



Application:

The LiveLink WiFi + RC system enables luminaires to be controlled without a control line. The functions of the system are largely identical to those of the LiveLink WiFi system. Due to the more limited size of the system, however, a different constellation results on the parking deck shown here compared to the previous example. The following also applies to all areas here: In case of presence the light is switched to the 100% level, in case of absence there is 20% basic light.

Parking bay areas (see figure 6, areas 1 and 3) and crossways (figure 6, areas 3 and 4) are switched in two areas each. In

particular, the entry of persons from the stairwell onto the parking deck and into the parking bay areas, even against the direction of travel, is reliably detected by the arrangement of the sensors. Lighting to meet the needs of parking deck users is guaranteed at all times. Some driveways are divided into several areas where leading light ensures that vehicles and people do not move into dark zones. Avoiding unnecessary lighting when people and vehicles are present also leads to a great energy and cost saving potential in this example.

In addition, reduced lighting operation also leads to a significant increase in the service life of the LED luminaires here.

Installation:

For controlled operation of an area, a LiveLink WiFi + RC controller luminaire AragonF...+LLWRCC) and LiveLink sensors are required. The luminaires to be controlled must have an integrated radio receiver (LiveLink RC module). In the present example, 2 sensor types with different operating principles and different detection characteristics are used. However, these must be wired to the DALI interface of the controller luminaire.

- **DUAL HF sensor:**
 - High-frequency sensor, detection of the reflection of an emitted signal.
 - Detection range 20 m · 3 m (10 m · 3 m in each direction).
 - 8 DALI devices
- **IS 3360 MX sensor:**
 - Passive infrared sensor, detection of heat radiation from moving persons and objects.
 - Detection range Ø approx. 36 m with ceiling heights up to 3 m.
 - Detection dependent on the intensity of the heat source.

- People in winter clothing, vehicles not yet at full operating temperature.
- Intensity depending on distance
(proportional to $\frac{1}{(distance)^2}$).
- Detection range can be restricted (shaded) with an aperture (see figure 8).
- 3 DALI devices

All luminaires are supplied separately with mains voltage. Up to 20 luminaires in a system are controlled via radio. The sensors are connected to the controller luminaire via a two-core DALI control line (see figure 8). It should be noted that the sensors must be taken into account when determining the max. 32 DALI devices that can be operated in a system.

Some IS 3360 MX sensors are equipped with apertures so that the detection area is shaded, as shown in figure 8 (see installation instructions of the sensor). In some driveways, several systems are required to control all installed luminaires. Since these function independently of each other, the detection ranges of the sensors of adjacent systems must overlap in the driveway (see figure 8). This way, leading light can be implemented, preventing any vehicles from driving into a dark zone.

Commissioning

The commissioning of the light management systems of a parking deck is carried out individually with the LiveLink INSTALL app. LiveLink WiFi requires registering the radio receivers of the luminaires as well as DALI addressing of the sensors. The components are assigned using the drag and drop functions of the app's graphical user interface. The use case "Universal" can be selected in the app for all systems.

- For all systems, all luminaires and sensors are each assigned to a group. Identifying the luminaires and sensors is not required for this.
- For all areas (all systems)
 - a light level of 100% (unregulated) is set,
 - a permanent basic light of 20% is set,
 - and a switch-off delay of 5 minutes is set.

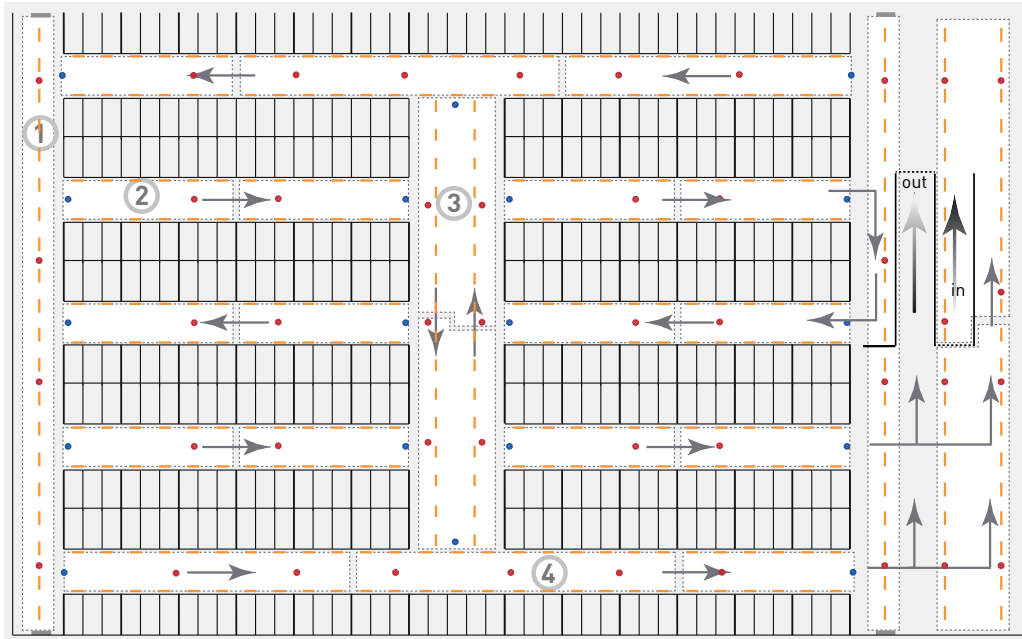


Figure 6:

Parking deck with 368 luminaires and 66 sensors in 24 systems LiveLink WiFi + RC.

- Individual system areas are highlighted in white.
- ● Dual **HF**
- ● IS 3360 MX.

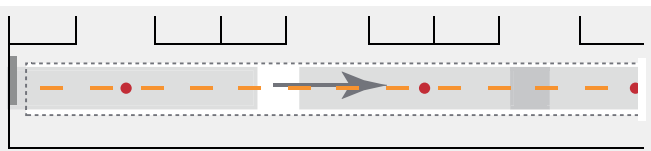


Figure 7:

Arrangement in the driveway

- Door in the detection range. Light is switched on when the door moves, independent of IR radiation (HF sensor).
- Safe detection of incoming vehicles.
- 20 radio 32 DALI devices (see figure 6).

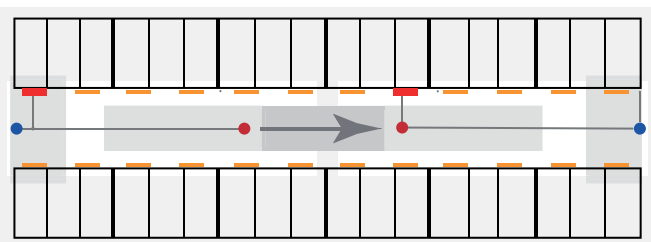


Figure 8:

Two systems in one parking bay area, arrangement and wiring of the components. The detection ranges of the sensors of the neighbouring systems overlap.

- ● Dual **HF**
- ● IS 3360 MX
- ■ Sensor detection ranges
- ■ Controller luminaire



Application:

The LiveLink WiFi system facilitates free configuration of luminaires, sensors and functions. On the parking deck shown here, 4 differently configured system operation modes in 13 areas are described. The following applies to all areas: In case of presence the light is switched to the 100% level, in case of absence there is 20% basic light.⁵

Parking bay areas (see figure 9, areas 1 and 3) and crossways (figure 9, areas 2 and 4) are switched individually. In particular,

the entry of persons from the stairwell onto the parking deck and into the parking bay areas, even against the direction of travel, is reliably detected by the arrangement of the sensors. Lighting to meet the needs of parking deck users is guaranteed at all times. The equally safe avoidance of unnecessary lighting in areas without the presence of people and vehicles leads to a high potential for energy and cost savings.

Monitoring functions enable the parking garage operator to record and evaluate usage times, energy consumption and other data for each LiveLink system using a cloud service.

Installation:

Controlled operation of an area requires a LiveLink controller luminaire⁶ [AragonF...+LLWC] and LiveLink sensors. The luminaires to be controlled must feature a DALI interface. In the present example, 2 sensor types with different operating principles and different detection characteristics are used for this purpose.

- **DUAL HF sensor:**
 - High-frequency sensor, detection of the reflection of an emitted signal.
 - Detection range 20 m · 3 m (10 m · 3 m in each direction).
 - 8 DALI devices
- **IS 3360 sensor:**
 - Passive infrared sensor, detection of heat radiation from moving persons and objects.
 - Detection range Ø approx. 36 m with ceiling heights up to 3 m.
 - Detection dependent on the intensity of the heat source.
 - People in winter clothing, vehicles not yet at full operating temperature.
 - Intensity depending on distance
(proportional to $\frac{1}{(distance)^2}$).

- Detection range can be restricted (shaded) with an aperture (see figure 11).
- 3 DALI devices

All luminaires are continuously connected with a mains voltage-proof 5-core cable for power supply and control. The sensors are only connected to the controller luminaire via the two DALI control lines (see figure 11). It should be noted that the sensors must be taken into account when determining the max. 64 DALI devices that can be operated in a system.

In **area 3** the number of DALI devices (luminaires + sensors) exceeds the maximum permissible value for a system. To operate all components together, 12 luminaires are connected to the output of a DALI repeater via their DALI interface. Sensors must always be connected directly to the controller (the controller luminaire) (see figure 13).

In the two **areas of type 4** the maximum number of DALI devices is also exceeded. Here, 2 repeaters are used per system to assign the luminaires connected at the output of the repeaters to different groups during commissioning (see figure 14).

Some IS 3360 sensors are equipped with apertures so that the detection area is shaded, as shown in figure 11 and figure 14 (see installation instructions of the sensor).

⁵"Leading light" is possible, see commissioning.

⁶Alternatively, the required LiveLink WiFi control devices can also be inserted into the sub-distribution and the DALI control lines routed from there to the areas of the luminaires to be controlled.

Commissioning

Commissioning of the light management systems of a parking deck is carried out individually with the LiveLink INSTALL app. LiveLink WiFi requires DALI addressing of all components (assignment of luminaires and sensors to groups), which is performed using the drag and drop functions of the graphical app interface. For all systems, the use case “Universal” can be selected in the app. This case makes it possible to freely assign up to 8 sensors and all system parameters to the maximum of 8 luminaire groups to be formed.

- For the 3 driveways of **type 1** as well as the systems of the 6 parking bay areas of **type 2**, all luminaires and sensors are each assigned to a group. Identifying the luminaires and sensors is not required for this.⁷

- For the driveway of **type 3**, all luminaires controlled via the repeater are displayed as one luminaire. All luminaires and sensors are also assigned to a group here (identification not required).
- For the two driveways of **type 4**, the luminaires are divided into three groups (see figure 14). To this end, the luminaires must be identified individually one after the other by calling them up and assigning them to the groups via drag and drop.
 - The sensors must also be identified and then assigned to the luminaire groups as shown in figure 14.
- For all areas (all systems and possibly luminaire groups),
 - a light level of 100% (unregulated) is set,
 - a permanent basic light of 20% is set,
 - and a switch-off delay of 5 minutes is set.

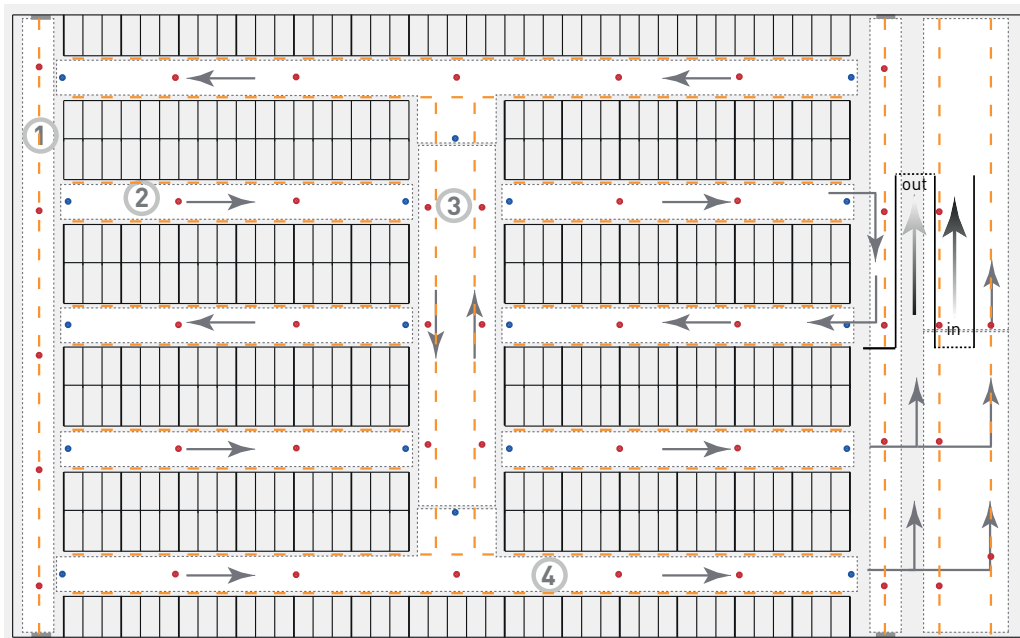


Figure 9:

Parking deck with 372 luminaires and 62 sensors

- ● Dual HF
- ● IS 3360.

a) in 13 LiveLink WiFi systems.

- Individual system areas are highlighted in white.
- There are 4 different configurations of the individual systems (see also the sketches below).

b) in 13 control areas in an overall system with LiveLink Premium (see page 22). A total of 778 DALI devices.

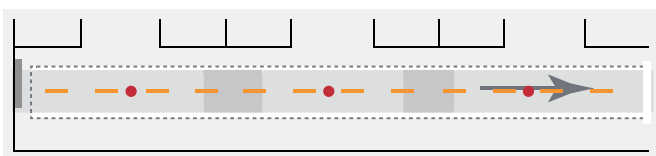


Figure 10:

Driveway arrangement (type 1).

- Door in the detection range. Light is switched on when the door moves, independent of IR radiation (HF sensor).
- Safe detection of incoming vehicles (overlapping).
- 62 DALI devices (see figure 9).

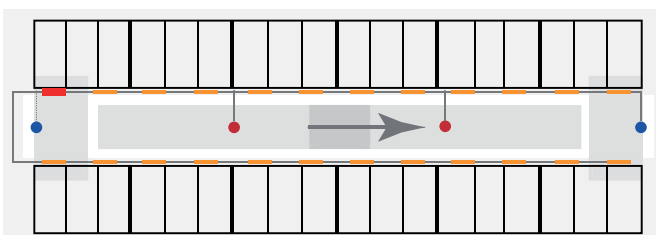


Figure 11:

Arrangement and wiring of the components and detection areas of the sensors in the parking bay areas (type 2).

- ● Dual HF
- ● IS 3360
- ■ Sensor detection ranges
- ■ Controller luminaire

⁷If the “leading light” function is to be set up, this requires grouping of the luminaires and suitable assignment of the sensors.

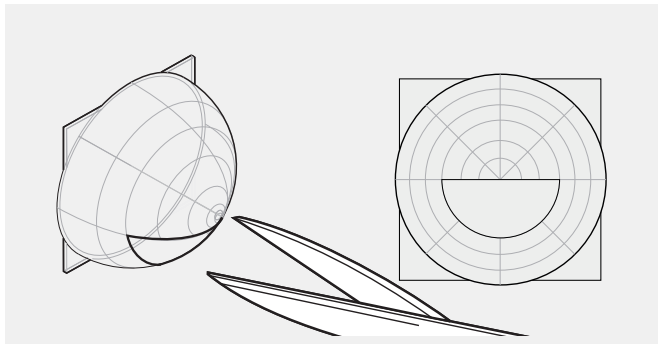


Figure 12:

Limiting the sensor detection range ● **IS 3360** using the aperture included in the scope of delivery.

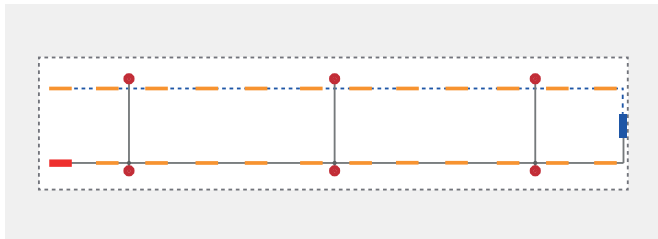


Figure 13:

Arrangement and wiring of the components in the middle of the driving area (type 3). This results in 61 DALI devices.

- ● Dual **HF**
- ■ Controller luminaire
- ■ Repeater
- — 5-core line DALI from controller luminaire interface output
- - - 5-core line DALI from repeater interface output.

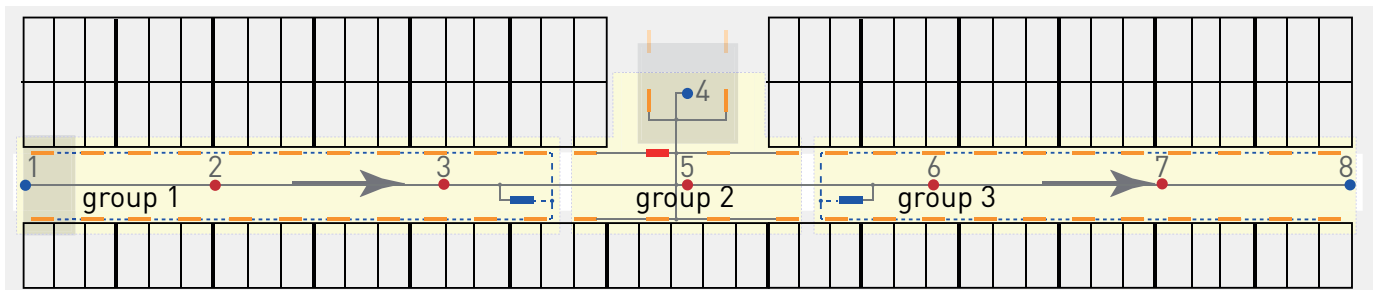


Figure 14:



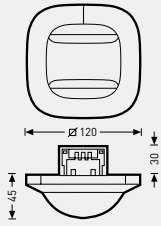
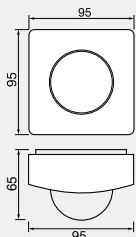
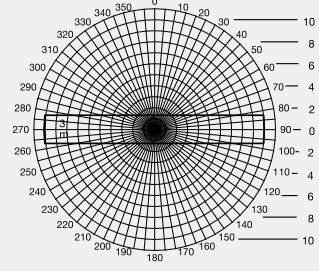
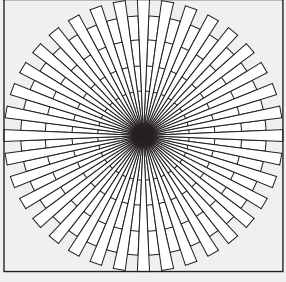
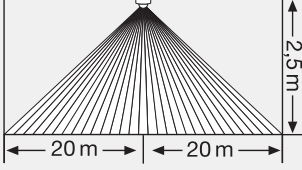
Arrangement and wiring of the components in the top and bottom of the driving area (type 4). This results in 61 DALI devices.

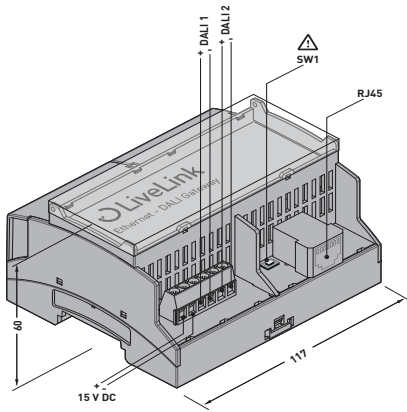
- ● Dual **HF**
- ● **IS 3360**
- ■ Controller luminaire
- ■ Repeater
- — 5-core line DALI from controller luminaire interface output
- - - 5-core line DALI from repeater interface output
- ■ 3 DALI groups
- ■ Detection ranges: Sensor 1 and 8 without shading, sensor 4 with shading.

Sensor assignment:

- Sensor 1 + 2: group 1
- Sensor 3: group 1 + 2
- Sensor 4: group 2
- Sensor 5 + 6: group 2 + 3
- Sensor 7 + 8: group 3

LIVELINK SENSORS

Type	Dual HF	IS 3360
		
Features	<ul style="list-style-type: none"> - dual directional characteristic for targeted detection of aisles and corridors - temperature-independent detection 	<ul style="list-style-type: none"> - for industry, production and warehouses as well as parking garages
Functionality	<ul style="list-style-type: none"> - Presence - Constant light 	<ul style="list-style-type: none"> - Presence
Sensor type	High-frequency	Passive Infrared (PIR)
Dimensions		
Place of operation	Indoor areas	Indoor areas
Sensor technology	High-frequency 5.8 GHz, transmission power < 1 mW	three highly sensitive pyro sensors with a detection angle of 360 degrees and an aperture angle of 180 degrees
Light value setting	10 lx to 1,000 lx	-
Protection rating	IP20 (IP54 with AP box)	IP54
Safety class	II	II
Temperature range	-20 °C to +55 °C	-20 °C to +50 °C
DALI devices	7	3
Installation height (ceiling mounting)	2.5 m to 3.5 m	2.5 m to 4 m
Detection angle/square	see diagram, range max. 20 m x 3 m (max. 10 m x 3 m in every direction)	Ø max. 40 m
Detection ranges	<p>for installation heights up to 3.0 m:</p>  <p>if necessary through glass, wood and drywall, continuously electronically adjustable</p>	<p>for installation heights up to 3.0 m:</p>   <p>If required, the detection range can be limited with an aperture (included in the scope of delivery)</p>



Application:

The LiveLink Premium system enables free configuration of all luminaires, sensors and functions in a room or building by integrating many DALI systems into a superordinate overall system. On the parking deck shown here, the functions in the 13 areas must be identical to those described in the LiveLink WiFi system example (see page 18).

Light monitoring enables the parking garage operator to record and evaluate the individual dimming states, usage times, energy consumption and ageing states (and expected remaining useful life) or even a defect/failure for each luminaire using a cloud service. A visualisation of the floor plan with the positions of all components enables, among other things, the assignment of the recorded operating data to the luminaires.

Installation:

For the controlled operation of an area, a LiveLink Premium server with additional network components, LiveLink Premium gateways and LiveLink sensors are required. The network components must be interconnected with network cables (RJ45) (see figure 16). The luminaires to be controlled must feature a DALI interface. If light monitoring is required, the control gear in the luminaires must also support this function (monitoring-ready). The sensors and their positions in the room must correspond to the LiveLink WiFi system example (see page 18).

It should be noted that the sensors must be taken into account when determining the max. 64 DALI devices that can be operated at the output of one gateway.

However, due to the integration of the DALI systems into the superordinate LiveLink Premium system, it is not necessary for the components of a functional area to belong to the same DALI system.

If monitoring functions are intended, all luminaires must be connected directly to the DALI interface of a gateway. The use of repeaters is not possible in this case.

In the **type 3 and 4 areas** there are more than 64 DALI devices, which are distributed to two outputs of one gateway. (see figure 15).

Commissioning

The commissioning of a parking deck light management system is carried out using an installation app. LiveLink Premium requires DALI addressing of all components (assignment of luminaires and sensors to groups) and their assignment to the respective position in the room. The room layout can be taken from a lighting design with DIALux or Relux. Assignment is

carried out using the drag and drop functions of the graphical app interface.

- For driveways of **type 1** and of **type 3** as well as the 6 parking bay areas of **type 2**, all luminaires and sensors are each assigned to a group (see figure 9 on page 19).
- For driveways of **type 4**, the luminaires are divided into three groups (see figure 15).

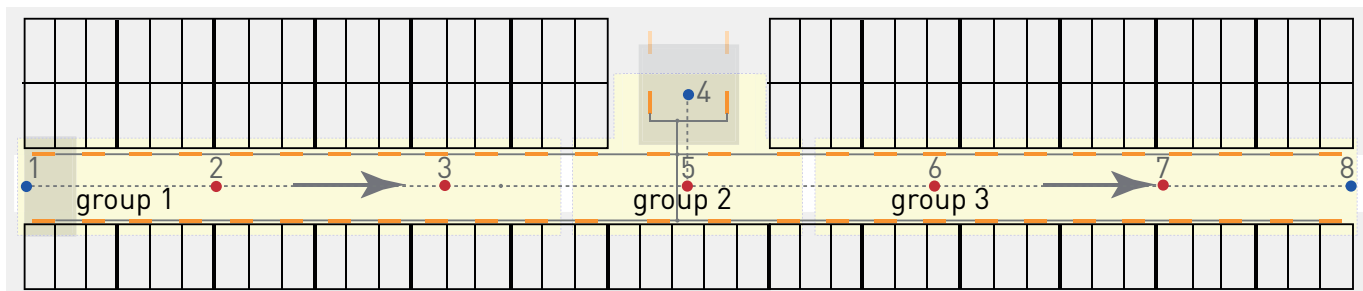


Figure 15:

Arrangement and wiring of the components in the top and bottom of the driving area (type 4). This results in 103 DALI devices, which are divided between the DALI systems of the two outputs of a DALI gateway.

- — All luminaires at one output of a gateway.
- - - - All sensors at the second output of the gateway.

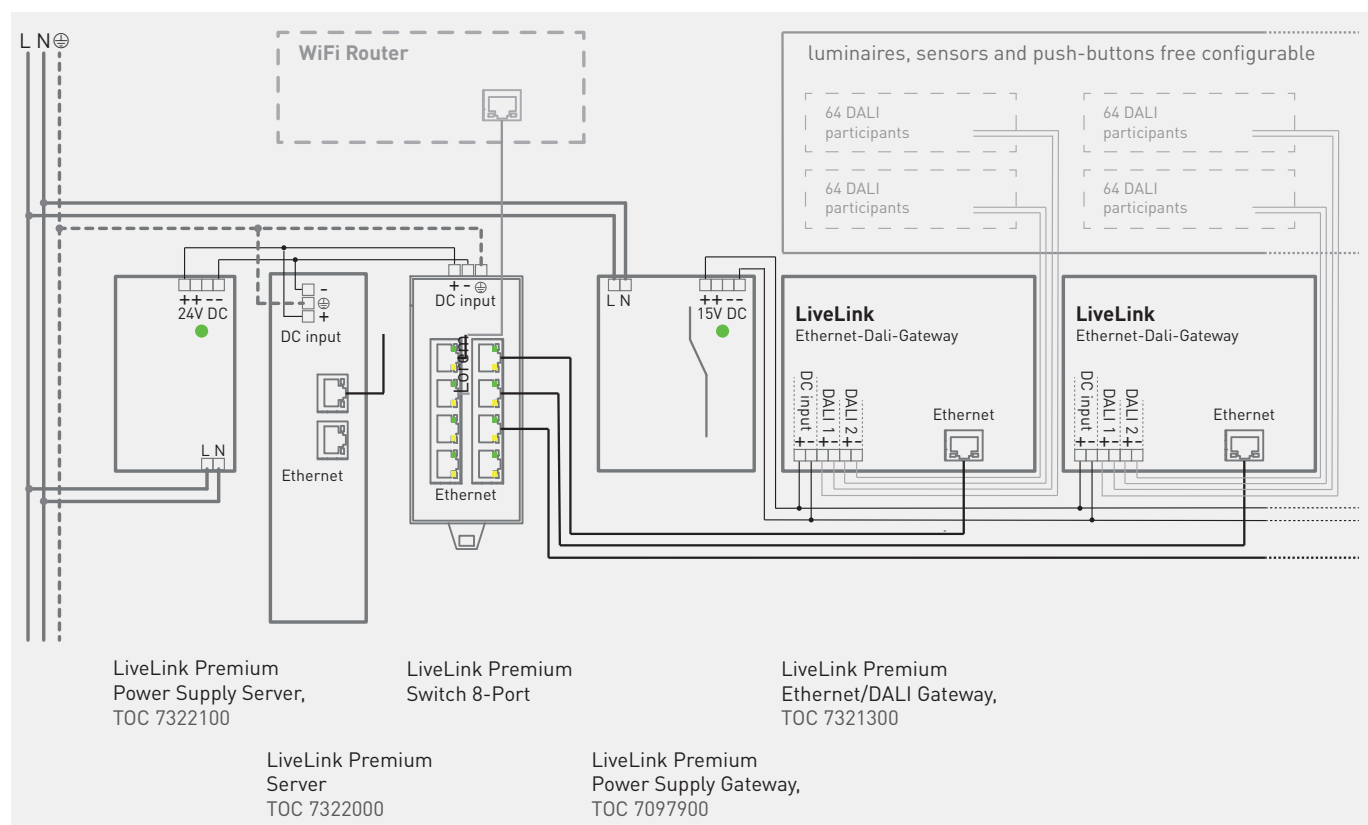


Figure 16: Overview of LiveLink Premium system components. The network components must be connected with network cables (RJ45) up to the Ethernet/DALI gateways. All DALI components must be connected to the gateways with 2-core control cables.



Application:

In stairwells, good visibility is the elementary prerequisite for accident prevention. In addition, it significantly determines the objective and subjective safety of the users. Diffuse wall luminaires have proven their worth here. Where luminaires are suitably positioned, the direction of light and shading emphasise the contours of steps, landings and any obstacles on the ground. At the same time, high vertical illuminance levels throughout the room ensure ideal conditions for recognising the faces of following or oncoming persons.

Modern LED luminaires with more than 100 lm/W provide this quality of light. To ensure the required lighting but also to

avoid unnecessary lighting in the long term, a fully automatic presence detection system has been set up.

When entering the stairwell, the light switches to 100% mode one floor up as well as down. When the floor is reached, another level is switched (leading light). Once the stairwell is empty, the return to basic light takes place after the delay time settable during commissioning.

With the HFSB/X system fully integrated into the luminaires, the sensor technology is not visible to the user of the stairwell.

In addition to energy savings, reduced lighting operation also leads to a significant increase in the service life of the LED luminaires.

Installation:

For controlled luminaire arrangement operation in the stairwell, one master luminaire 74R...HFSB is required per floor. All other luminaires must feature a DALI interface.

All luminaires in the arrangement are connected with a 5-core line for power supply and control. The following should be taken into account (see fig. 17 and fig. 18):

74R...ETDD + HFSB luminaires:

- Equipment with 2 pairs of DALI terminals
 - 1 pair of DALI terminals "Slave" (DALI input)
 - 1 pair of DALI terminals "Master" (DALI output)
- The master luminaire forms a DALI system with max. 15 DALI devices with DALI luminaires connected at the DALI output

- The control device input receives a signal from the previous master's output
- The control device sends control signals at the output
- The row arrangement is continued only in one direction (at the DALI output of the HFSB luminaire)

74R...ETDD luminaires:

- DALI luminaires must be connected to the DALI terminals "Master" (DALI output) of the controlling master luminaire

The first master luminaire 74R...HFSB (luminaire 2 in fig. 17 and fig. 18) is installed on the lowest floor. DALI luminaires 1 and 3 are connected to the master luminaire using the "Master" DALI terminal. The DALI connection is forwarded to the DALI terminal "Slave" of the next master luminaire (luminaire 6 in fig. 17). The other DALI luminaires up to the DALI terminal "Slave" of the next master luminaire (luminaire 10 in fig. 17) are again connected to the DALI terminal "Master".

Commissioning

Commissioning of the light management system in the stairwell can be carried out in a few minutes using the IR remote control as described in the luminaire operating instructions:

- Settings are made on any master luminaire of the luminaire row

- The light level for presence (depending on the design, generally 100 %) and the basic light level (20 %) are set
- The group behaviour "swarm" is set for leading light
- The switch-off delay is set to 3 minutes
- With "send all", the settings are transmitted to all master luminaires in an arrangement

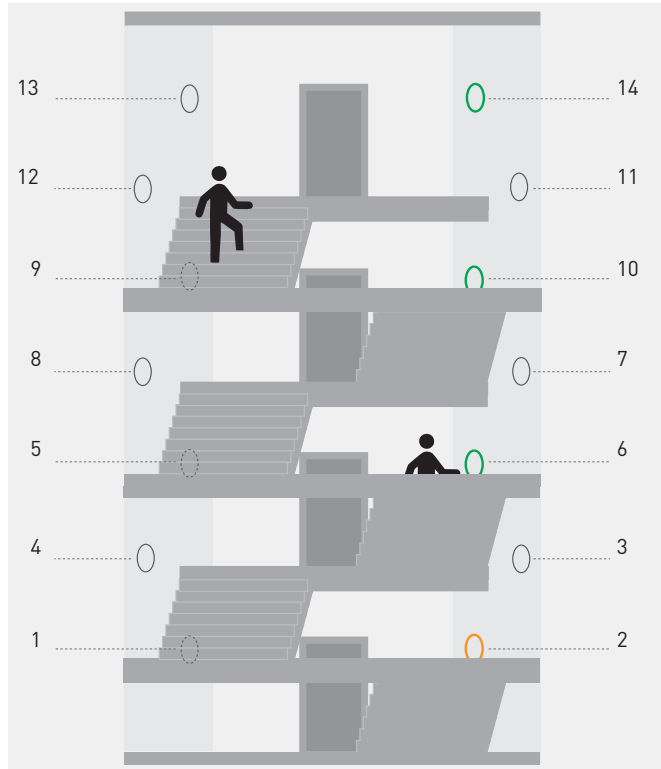


Figure 17:

Stairwell with 4 master luminaires 74R...HFSB and 10 additional DALI luminaires:

- Sensors in master luminaires near the doors of the parking decks
- 1 master luminaire per floor
- Leading light ("swarm")
- Light switches automatically to 100% operation
 - when motion is detected by a master luminaire
 - on the floor above and below the master luminaire
 - in each case up to the next master luminaire
- Switching back to basic light level – 20 % – if no further movement was detected in the area for 3 minutes

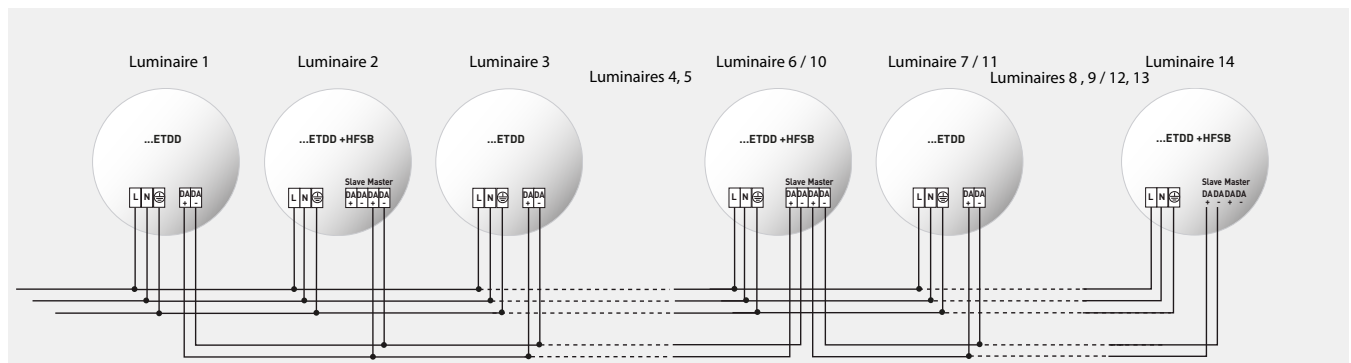


Figure 18:

Arrangement and connection of wall luminaires in the stairwell for "leading light"

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