interact

System guide

Architecture PRF/PRA

Version v2.7

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Contents

Interact Pro is a wireless smart lighting system that's easy to install, setup and manage. Commissioning and operating the system is made simple and efficient using the Interact Pro mobile app and web portal.

A portfolio of Interact ready luminaires and devices is available to suit a wide range of applications. These luminaires and devices connect to form wireless networks that enable system operation.

The smart lighting system can be operated in a standalone configuration, or gateways can be added to wireless networks to enable additional cloud connected features.

1. Application overview

Interact Pro is designed to install, setup and manage a lighting system in projects of the following application types:

- Office
- Industry
- Educational Institutions
- Municipal Buildings
- Care Facilities
- Retail
- Building perimeters
- Outdoor parking lots
- Covered parking garages

2. Project structure

A project is created for a site where Interact ready luminaires and devices are being installed. Within each project, one or more wireless networks are created based on the physical layout of the site and the number of Interact ready luminaires and devices installed. Additional networks may be required to overcome wireless obstructions on site.

2.1. Wireless Networks

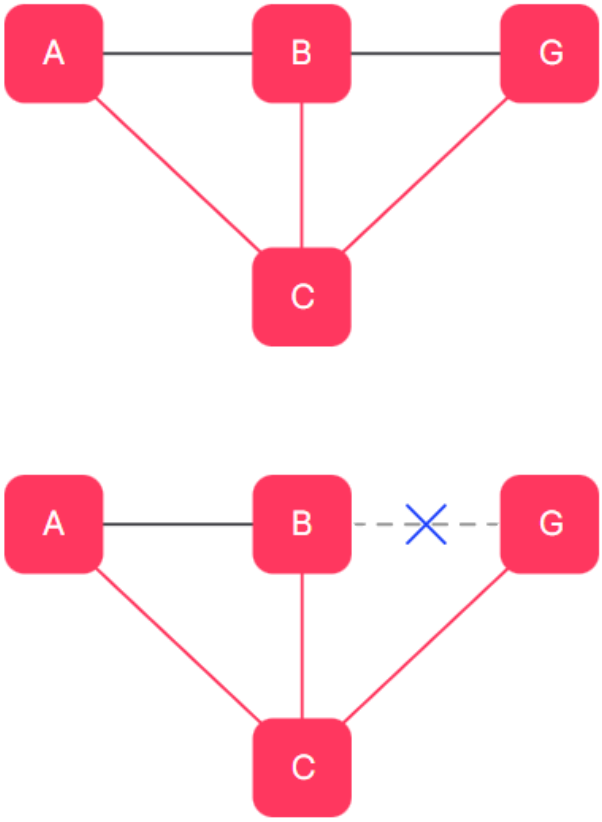
Wireless networks are required to enable secure and scalable wireless communication within the lighting system and are created using the Interact Pro app or web portal.

Interact ready luminaires and devices use the Bluetooth Low Energy (BLE) wireless communication protocol to communicate with mobile phones. This enables mobile phones using the Interact Pro app to discover and add Interact ready luminaires and devices to wireless networks. In networks without gateways, BLE also enables mobile phones to deploy behavior configurations and control the lighting system locally.

Interact ready luminaires and devices within a wireless network communicate with each other using the Zigbee wireless communication protocol. Zigbee forms a wireless mesh between devices added to the network and enables the configured operation of the lighting system. The advantage of a mesh network is the capability for self-healing by using automatic route discovery.

2.2. Routing between wireless devices

The lights of a wireless system are guaranteed to work if the distance between the light and at least one of the other lights in the network is less than or equal to 10 m (depending on the sensor type). It is preferred to have at least two lights within the range of each light, as the wireless Zigbee network uses mesh routing, as shown below:



This makes the network much more robust as multiple routing paths can be used for communication.

The connection from light A to the gateway G can go via light B. If for some reason the connection between A and B is blocked, the network will automatically route the traffic through light point C.

These require the light to be installed within the reach of at least two other lights within 10 m (33 ft).

As the Zigbee Green Power devices (sensors and switches) only send messages in the Zigbee network, they exist in the network but play no role in the routing between the wireless devices.

Wireless networks operate in the 2.4GHz frequency band, which is used by 2.4 GHz Wi-Fi, Bluetooth and Zigbee. Although these technologies have been designed to co-exist in the 2.4 GHz band, it is still important to choose wireless network Zigbee channels carefully to avoid any potential interference. The Zigbee channel is user-selectable when creating a wireless network.

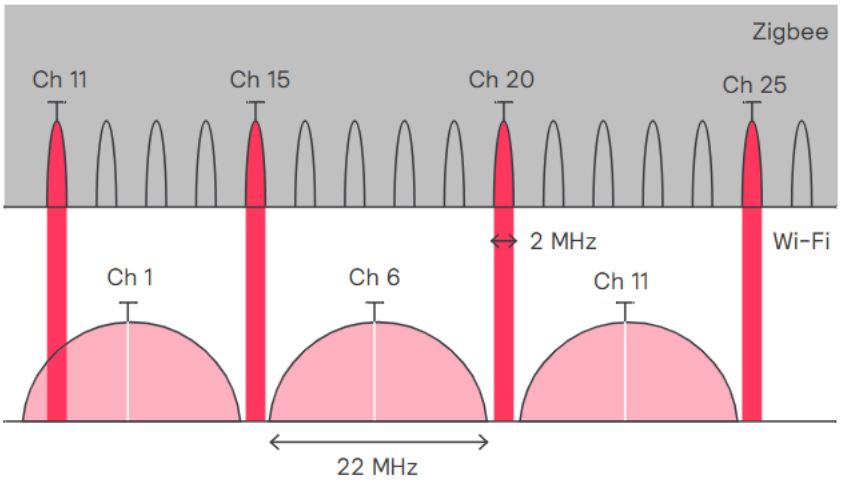
2.3. Channel selection

As Wi-Fi channels overlap each other, it is required to select non-overlapping channels to ensure best possible communication.

Interference between overlapping channels results in lower transmission speeds or at worst no communication at all.

In a well-managed Wi-Fi system, channels 1, 6 and 11 are used to create a network with full coverage without access points interfering with each other. Using these channels also leaves gaps in the frequency band.

The wireless Zigbee network uses channels 11, 15, 20 and 25 that are positioned in the gaps of the Wi-Fi band, as shown below:



2.4. Interference

Devices using Ultra High Frequency (UHF) radio signals are sensitive to interference. However, systems using frequencies in the 2.4 GHz band are designed to coexist.

Also, for the wireless Zigbee network, the transmitting powers are significantly lower when compared to Wi-Fi, mobile telephony etc. The table shows the relation between the maximum permitted powers for several types of radio signals.

Overview of maximum permitted powers for several appliances operating in UHF frequency bands

Device / Type	**Max. permitted power**	
	Transmitting power	**Power ratio**
Microwave	1000 W	60 dBm
Mobile telephone (GSM)	2 W	33 dBm
Wi-Fi (at 2.4 GHz)	100 mW	20 dBm
Bluetooth	100 mW	20 dBm
Zigbee	2.5 mW	4 dBm

To ensure reliable Zigbee communication within wireless networks, the following application-specific distance limitations between luminaires and devices should be observed:

Office/Educational Institution applications - 10 m (33 ft) Industry/Warehouse/Retail applications - 15 m (49 ft) Outdoor Parking applications (only for LCN4120, LCN4150) - 49 m (160 ft)

Distances vary depending on the sensor type, refer to each sensor data sheet for maximum distances allowed by each device.

Wireless gateways should be within the specified application range of at least two mains powered wireless luminaires or devices in their respective wireless networks. Ideally, they should be mounted in a central location within the network for maximum reliability. Zigbee Green Power (ZGP) devices do not count as devices in range in this instance since they do not repeat Zigbee messages.

2.5. Groups

Groups are created within wireless networks using the Interact Pro app or web portal. Groups are where the behavior of the smart lighting system is defined. Groups enable Interact ready luminaires and devices to be linked together wirelessly to respond to occupancy, vacancy and light level using various configurable light behavior templates. They also enable user interface control, scene setting and schedule control.

2.6. Zones

Zones are optionally created within groups using the Interact Pro app or web portal. Zones allow for Interact ready luminaires and devices to be linked together to respond in unison to scenes. Zones are also required to enable Daylight Dependent Regulation (DDR) within groups.

3. System security

Interact Pro functions in a secured environment, ensuring privacy and security to the users' data. The key features include:

- Wireless Zigbee protocol based on 128-bit AES key encryption
- Bluetooth protocol based on 256-bit AES key encryption

Refer to the Security Statement for further details.

4. Key features

The system can be installed with or without wireless gateways. When installed without a gateway, the luminaires and sensors within a wireless network operate in a standalone architecture with lighting control capability and energy saving functionality. Adding a gateway to a wireless network enables additional functionality by connecting the network to the cloud. The following table provides a list of features available with/without a gateway.

Feature	Without gateway	With Gateway
Motion sensing	✔	✔
Daylight dependent regulation (DDR)	✔	✔
Daylight dependent switching	✖	✔
Outdoor parking daylight override	✔	✔
Wireless switches for manual control	✔	✔
Light behavior templates	✔	✔
Scenes	✔	✔
Tunable White	✔	✔
High end trim	✔	✔
Schedules	✖	✔
Remote control	✖	✔
System monitoring	✖	✔
Energy reporting	✖	✔
Project updates	✖	✔
Demand response	✖	✔

4.1. Motion sensing

Motion sensing allows the system to automatically switch on the lights when a group becomes occupied (auto on) and switch them off when the group becomes vacant (auto off).

4.2. Daylight Dependent Regulation (DDR)

Daylight Dependent Regulation allows the system to take advantage of the ambient light coming through windows or translucent ceilings to dim the lights to a minimum of 0%, 5% or 20%. This is achieved by using

the sensors to continuously measure the light level and adjust the brightness of the luminaires to keep the light level at a target setpoint.

4.3. Daylight Dependent switching

Daylight Dependent switching allows the lights in DDR zones to switch off completely (dim to off) when the ambient light level is sufficient.

4.4. Outdoor parking daylight override

Outdoor parking daylight override allows for the outdoor parking sensors (LCN4120, LCN4150) to switch off when ambient light is sufficient. This enables luminaires in outdoor parking applications to remain off during the day and only operate at night, or when low light level conditions occur.

4.5. Switches for manual control

Wireless switches provide users with the ability to manually control their lighting environment. These switches offer various functionalities such as on/off control, dimming, color temperature adjustment and scene selection.

4.6. Light behavior templates

Light behavior templates are predefined configurations that determine how groups of lights respond to motion (occupancy), no motion (vacancy) and light level (DDR). These templates contain light level and time delay parameters that can be customized to suit specific needs and scenarios.

4.7. Scenes

Scenes are used to set the intensity level of individual lights or zones in a group for manual recall. If Tunable White lights are in the group, the color temperature can also be adjusted. They can be recalled using switches, the app, and if gateways are used, the web portal. Two scenes can be assigned to 4-button switches.

4.8. Tunable White

Interact ready luminaires that support Tunable White allow for control of the output color temperature in addition to light intensity.

4.9. High end trim

High end trim limits the maximum output level of a group of lights. Selecting a high-end trim other than default (no trim) lowers the maximum possible light output of the group.

4.10. Schedules

Schedules provide the ability to define control behaviors for groups at selected day(s) of the week and at a fixed time of day. A single schedule can be defined with actions for multiple groups, with on, off and scene selection actions available for each group.

4.11. Remote control

In projects with gateways, remote control enables users to perform on/off control, dimming, color temperature adjustment and scene selection of their lighting system from anywhere, using the app or portal. For experts, behavior configuration changes and remote deployment using the app are also possible.

4.12. System monitoring

The Interact Pro web portal provides system monitoring capabilities. Energy consumption can be viewed and Interact ready luminaires and devices that have failed or are degraded (> 80% of lifespan burning hours) are reported.

4.13. Energy reporting

Energy reporting allows users to generate .csv reports for specified date ranges up to one year prior. In the report, incremental energy consumption (in Wh) is reported every 15 minutes for every group in the project.

4.14. Project updates

The Interact Pro app, web portal and cloud are regularly updated to enable new features and fix issues. New device firmware may also be released to support these updates. Over-the-air (OTA) project updates are essential for keeping the system devices up to date with the latest firmware, ensuring optimal functionality and security and enabling new system features as they become available.

4.15. Demand response

Demand response allows the lighting system to temporarily reduce its energy consumption. It operates as a temporary high-end trim across the entire project. In projects with gateways, manual and automatic demand response (ADR) options are available. ADR requires the addition of a dedicated ADR gateway and supporting infrastructure to achieve demand response through OpenADR. ADR enables automatic system response to requests sent by the local utility company to reduce energy consumption during times of peak energy usage.

5. System limitations

Account level

Feature	Maximum limit
Max projects per Expert account	500

Project level

Feature	Maximum limit
Light networks/ gateways	100
Schedules	16
Groups/schedule	16
Expert accounts per project	10
User accounts per project	multiple

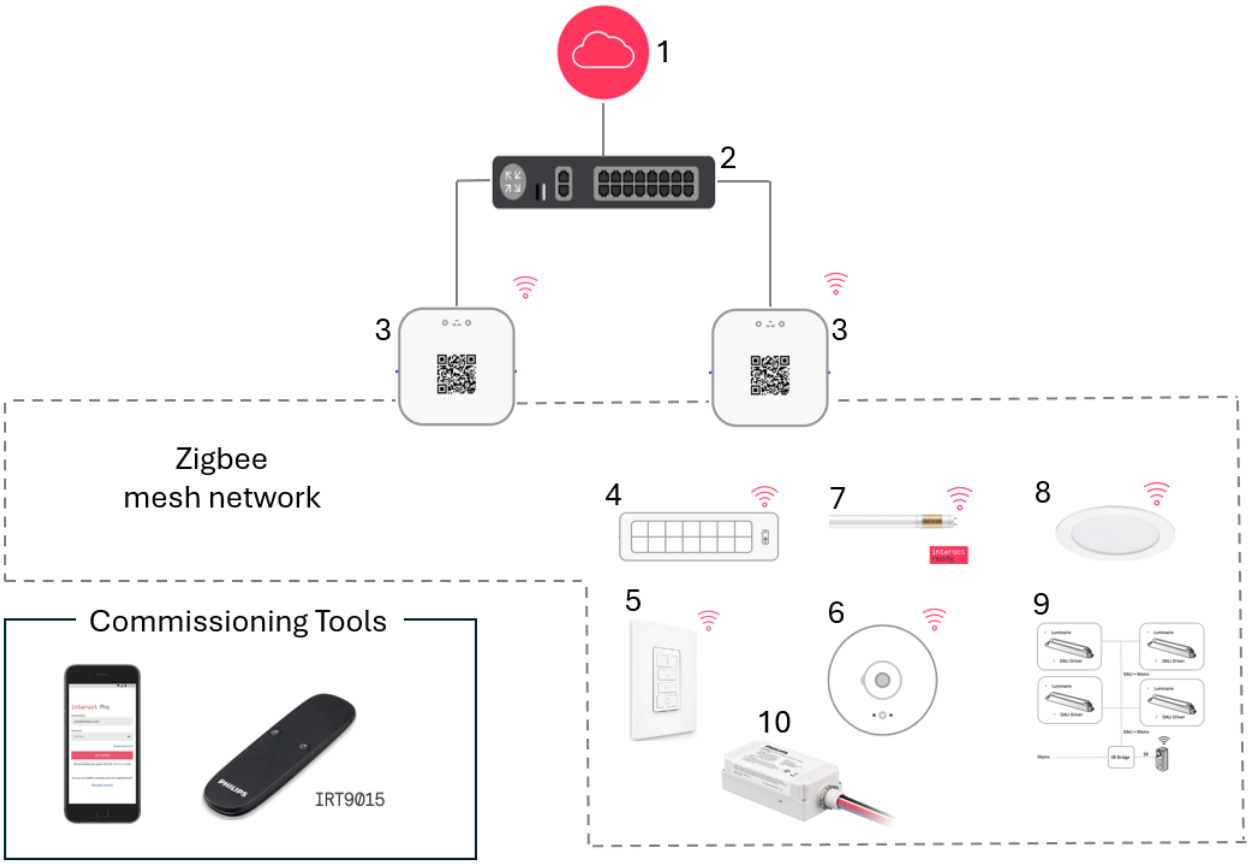
Wireless light network level

Feature	Maximum limit
Lights (Interact ready luminaires, switch relays, Smart T-LEDs)	200
Zigbee Green Power (ZGP) devices (switches + battery powered sensors)	50
Switches	50
Sensors (battery powered)	30
Groups + zones	64
Scenes	128

Group level

Feature	Maximum limit
Lights	200
Zigbee Green Power (ZGP) devices (switches + battery powered sensors)	5
Scenes	16

6. System components



1-Interact Cloud, 2-IT infrastructure, 3-Wireless gateway, 4-Luminaires with built-in sensors/transceivers, 5-Wireless switches, 6-Battery powered ZGP sensors, 7-Smart T-LEDs, 8-Luminaires with wireless drivers, 9-DALI and 0-10V bridges with sensors/transceivers, 10-Switch relay.

6.1. Wireless gateway

The wireless gateway communicates with Interact ready luminaires and devices within a wireless network using Zigbee. Adding a gateway to a wireless network enables additional functionality (described in the Key Features overview) by connecting the network to the cloud.

6.2. Luminaires with built-in sensors

Luminaires with built-in sensors integrate sensing capabilities and wireless communication directly into the luminaire assembly. The mains powered SR (Sensor Ready) driver(s) in the luminaire power and communicate with the built-in sensor, which contains the Bluetooth and Zigbee antennas. Other than mains power to the luminaire, no additional wiring or external sensors are required.

6.3. Luminaires with built-in transceivers

Luminaires with built-in transceivers integrate wireless communication directly into the luminaire assembly. The mains powered SR (Sensor Ready) driver(s) in the luminaire power and communicate with the built-in transceiver, which contains the Bluetooth and Zigbee antennas. Other than mains power to the luminaire, no additional wiring is required. Transceivers do not have sensing capabilities, so they must be grouped with external sensors or with luminaires with built-in sensors for automatic behavior configurations.

6.4. Luminaires with wireless drivers

Luminaires with wireless drivers integrate wireless communication directly into the luminaire. The mains powered wireless driver(s) in the luminaire contains the Bluetooth and Zigbee antenna. Other than mains power to the luminaire, no additional wiring is required. Wireless drivers do not have sensing capabilities, so they must be grouped with external sensors or with luminaires with built-in sensors for automatic behavior configurations.

6.5. Smart T-LEDs

Smart T-LEDs integrate wireless communication directly into the lamp. Each mains powered Smart T-LED lamp has the Bluetooth and Zigbee antenna built-in. Other than mains power to the fixture, no additional wiring is required. Smart T-LEDs do not have sensing capabilities, so they must be grouped with external sensors or with luminaires with built-in sensors for automatic behavior configurations.

6.6. DALI and 0-10V

DALI and 0-10V bridges enable wireless control for non-Interact ready luminaires with DALI or 0-10V drivers. The mains powered S (Sensor Ready) bridge powers and communicates with a sensor or transceiver, which contains the Bluetooth and Zigbee antennas. The bridge itself is equipped with a power switching relay and a signal output (DALI or 0-10V) to switch and dim the connected non-Interact ready luminaires. The same grouping concepts outlined for luminaires with built-in sensors vs transceivers apply.

6.7. DALI extender

The DALI Extender extends the SR bus to the DALI bus and enables multiple applications requiring connecting SR devices to DALI drivers or DALI emergency drivers. It provides supply to SR bus and DALI bus. This device enables longer cost-effective trunking lines with lower number of sensors, remote testing of emergency luminaires and connection to third-party tunable white drivers making the system inclusive. The DALI Extender can be installed independently or be built-in to luminaire.

6.8. Switch relays

Switch relays enable wireless control for non-Interact ready luminaires with 0-10V drivers as well as other on/off switching loads such as receptacles, signage, etc. The mains powered switch relay contains the Bluetooth and Zigbee antennas and is equipped with a power switching relay and a signal output (0-10V).

Switch relays do not have sensing capabilities, so they must be grouped with external sensors or with luminaires with built-in sensors for automatic behavior configurations.

6.9. Wireless switches

Wireless switches provide a user interface for on/off control, dimming, color temperature adjustment and scene selection.

6.10. Battery powered ZGP (Zigbee Green Power) sensors

External battery powered ZGP sensors are used to control luminaires with wireless transceivers and/or wireless drivers. Battery powered occupancy sensors can also be grouped with luminaires with built-in sensors to extend motion coverage within a group.

7. User roles

The Interact Pro system involves two key roles – expert and user — each with specific responsibilities and permissions. Here is an overview of the different roles and their responsibilities:

7.1. Expert

Expert role is used to commission and maintain a project. Expert role-holders are typically installers, commissioning engineers and facility managers. There can be multiple experts assigned to a project.

7.2. User

User role is used to perform light control operations only, with restricted group access assigned to users by experts. This role is intended for end user occupants who would like personal control over assigned groups using the Interact Pro app or web portal. Users are only supported in projects with gateways.

8. Access per role

The following table provides the details of the access controls available with the Expert and the User roles:

Account level

Action/Role	Expert	User
Request access (register)	✔	✖
Invite others	✔	✖
Delete others	✔	✖
Create projects (networks, groups, zones)	✔	✖
Commission projects (app only)	✔	✖
Update projects (with gateways)	✔	✖
Manage projects (behavior, scenes, replacement	✔	✖
Energy & health (gateway projects, web portal only)	✔	✖
Energy reports (gateway projects, web portal only)	✔	✖
Manage schedules (gateway projects)	✔	✖
Control lights	✔	✔

9. System behavior

System behavior refers to the predefined actions and responses of the lighting system, based on various triggers and settings.

9.1. Motion detection

The motion sensor is based on PIR technology. PIR sensors need direct line of sight to detect a moving object, and the detection pattern varies based on the installation height.

9.2. Daylight Dependent Regulation

Daylight Dependant Regulation (DDR) measures light levels and maintains a desired calibrated lux level (set point) by dimming up or down a single or a set of luminaires. In other words, when ambient light starts entering the building, the luminaires will dim down, and when it gets dark, the lights will automatically brighten to maintain the desired light level.

9.3. Light behavior templates

Light behavior templates enable different group responses to motion, vacancy and light level (DDR). Each template contains a set of configurable parameters allowing for light level and time delay adjustments. When a template is selected for a group, the light behavior is set for all the luminaires and devices inside that group based on the configured template.

9.4. Available templates:

Area Manual On Manual Off: The group does not respond to occupancy or vacancy. A user override (wall switch, mobile app/portal light control or schedule) is required to turn the lights on, off or to a specific scene, dim level or color temperature.

Area Manual On Manual Off with DDR: The group does not respond to occupancy or vacancy. A user override (wall switch, mobile app portal light control or schedule) is required to turn the lights on, off or to a specific scene, dim level or color temperature. When lights are manually switched On to Task Level, lights added to zones within the group will begin to regulate their light level to try and maintain the calibrated setpoint. Built-in sensors regulate their light level individually, while devices without a built-in sensor require a battery powered multi-sensor in the zone for regulation.

Area Manual On Auto Off with DDR: The group does not initially respond to occupancy. A user override (wall switch, app/portal light control or schedule) is required to turn the lights on, off or to a specific scene, dim level or color temperature.

Once the Hold time expires after vacancy, the group will transition from its current state to Background level if a Prolong time has been set. Once the Prolong time expires, the group will transition from Background to Vacant level. If motion is detected during the Prolong time, the group will transition from

Background level to Task level. If the Prolong time is not set (0 minutes), the group will transition directly from its present state to Vacant level once the Hold time expires.

When lights are manually switched On to Task level, lights added to zones within the group will begin to regulate their light level to try and maintain the calibrated setpoint. Built-in sensors regulate their light level individually, while devices without a built-in sensor require a battery powered multi-sensor in the zone for regulation.

Area Auto On Auto Off: The group responds to both occupancy and vacancy. Upon occupancy, the group will transition from Vacant level to Task level. User overrides (wall switch, app/portal light control or schedule) can turn the lights on, off or to a specific scene, dim level or color temperature.

Once the Hold time expires after vacancy, the group will transition from its current state to Background level if a Prolong time has been set. Once the Prolong time expires, the group will transition from Background to Vacant level. If motion is detected during the Prolong time, the group will transition from Background level to Task level. If the Prolong time is not set (0 minutes), the group will transition directly from its present state to Vacant level once the Hold time expires.

Area Auto On Auto Off with DDR: The group responds to both occupancy and vacancy. Upon occupancy, the group will transition from Vacant level to Task level. User overrides (wall switch, app/portal light control or schedule) can turn the lights on, off or to a specific scene, dim level or color temperature.

Once the Hold time expires after vacancy, the group will transition from its current state to Background level if a Prolong time has been set. Once the Prolong time expires, the group will transition from Background to Vacant level. If motion is detected during the Prolong time, the group will transition from Background level to Task level. If the Prolong time is not set (0 minutes), the group will transition directly from its present state to Vacant level once the Hold time expires.

When lights are switched On to Task level, lights added to zones within the group will begin to regulate their light level to try and maintain the calibrated setpoint. Built-in sensors regulate their light level individually, while devices without a built-in sensor require a battery powered multi-sensor in the zone for regulation.

Light Auto On Auto Off: The group responds to both occupancy and vacancy. Upon occupancy, the group will transition from Vacant level to Background level. Individual built-in sensors that detect motion for greater than the Dwell time will transition from Background to Task level. User overrides (wall switch, app/portal light control or schedule) can turn the lights on, off or to a specific scene, dim level or color temperature.

Once the Hold time expires after vacancy, individual built-in sensors will transition from Task to Background level. Once all individual sensors in the group have returned to Background level, a static 5-minute Sync time must elapse to ensure vacancy. After the Sync time, the group continues to remain at Background level for the Prolong time. Once the Prolong time expires, the group will transition from Background to Vacant level. If motion is detected during the Sync Time or the Prolong time, the individual built-in sensors detecting motion will transition from Background level to Task level. If the Prolong time is not set (0 minutes), the group will transition directly from its present state to Vacant level once the Hold and Sync times expire.

Light Auto On Auto Off with DDR: The group responds to both occupancy and vacancy. Upon occupancy, the group will transition from Vacant level to Background level. Individual built-in sensors that detect motion for greater than the Dwell time will transition from Background to Task level. User overrides (wall switch,

app/portal light control or schedule) can turn the lights on, off or to a specific scene, dim level or color temperature.

Once the Hold time expires after vacancy, individual built-in sensors will transition from Task to Background level. Once all individual sensors in the group have returned to Background level, a static 5-minute Sync time must elapse to ensure vacancy. After the Sync time, the group continues to remain at Background level for the Prolong time. Once the Prolong time expires, the group will transition from Background to Vacant level. If motion is detected during the Sync Time or the Prolong time, the individual built-in sensors detecting motion will transition from Background level to Task level. If the Prolong time is not set (0 minutes), the group will transition directly from its present state to Vacant level once the Hold and Sync times expire.

When lights are switched On to Task level, lights added to zones within the group will begin to regulate their light level to try and maintain the calibrated setpoint. Built-in sensors regulate their light level individually, while devices without a built-in sensor require a battery powered multi-sensor in the zone for regulation.

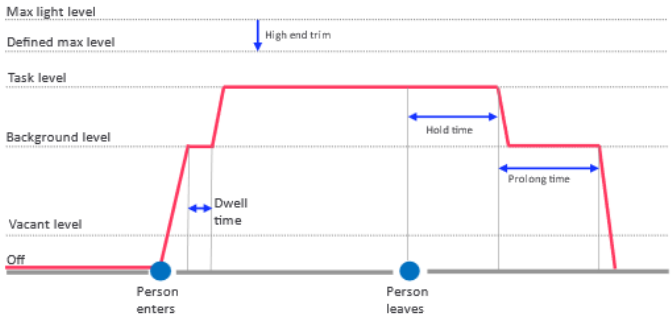
9.5. Light behavior parameters

Light behavior templates enable different group responses to occupancy, vacancy and light level (DDR). After selecting a light behavior template, parameters can be adjusted to tailor the light behavior according to the needs.

9.6. Parameter matrix per light behavior template

Template	Levels			Time Delays		
	Task Level	Background Level	Vacant Level	Hold Time	Prolong Time	Dwell Time
Area Manual On Manual Off	✓	-	-	-	-	-
Area Manual On Manual Off with DDR	✓	-	-	-	-	-
Area Manual On Auto Off	✓	✓	✓	✓	✓	-
Area Manual On Auto Off with DDR	✓	✓	✓	✓	✓	-
Area Auto On Auto Off	✓	✓	✓	✓	✓	-
Area Auto On Auto Off with DDR	✓	✓	✓	✓	✓	-
Light Auto On Auto Off	✓	✓	✓	✓	✓	✓
Light Auto On Auto Off with DDR	✓	✓	✓	✓	✓	✓

9.7. Occupancy-based light behavior



9.8. Light behavior parameter summary

Parameter	Description	Min Value	Max Value
Task Level	The light level that the group switches to upon occupancy when any Auto On template is used, or in response to a manual on command. If DDR is enabled, the task level behaves as a switch-on level, then the light regulation begins.	1%	100%
Background Level	The light level that the group switches to during the prolong time when any Auto Off template is used. Background level is used as a warning level before the lights switch to vacant level. The light level that the group switches to during dwell time when any Light Auto On template is used.	0%	100%
Vacant Level	The light level that the group switches to once the hold and prolong times have expired, when any Auto Off template is used. This level is maintained until motion is detected.	0%	100%
Hold Time	The time that the group maintains its current state before switching to background level (prolong time > 0) or directly to vacant level (prolong time = 0), when any Auto Off template is used.	5 min	60 min
Prolong Time	The time that the group maintains the background level after the hold time expires before switching to vacant level, when any Auto Off template is used.	0 min	30 min
Dwell time	The minimum amount of time that luminaires with built-in sensors must detect motion before switching from background level to task level, when any Light Auto On template is used. Upon occupancy, the whole group switches on to background level, then individual luminaires will switch to task level if they detect “dwelling” motion longer than the dwell time.	0 sec	30 sec

9.9. Zones and Scenes

A zone is a sub-selection of luminaries inside a group. Zones allow multiple luminaires to be set in unison when Scenes are configured vs lights in the group that are not in zones, which must be individually set. In addition, luminaires must be in zones to enable Daylight Dependent Regulation (DDR).

A scene can be triggered either by a single press of a button from a 4-button switch, the LightControl application, or via a schedule. A scene always behaves as a manual override, meaning lights resume normal or automatic behavior once the group Hold time expires.

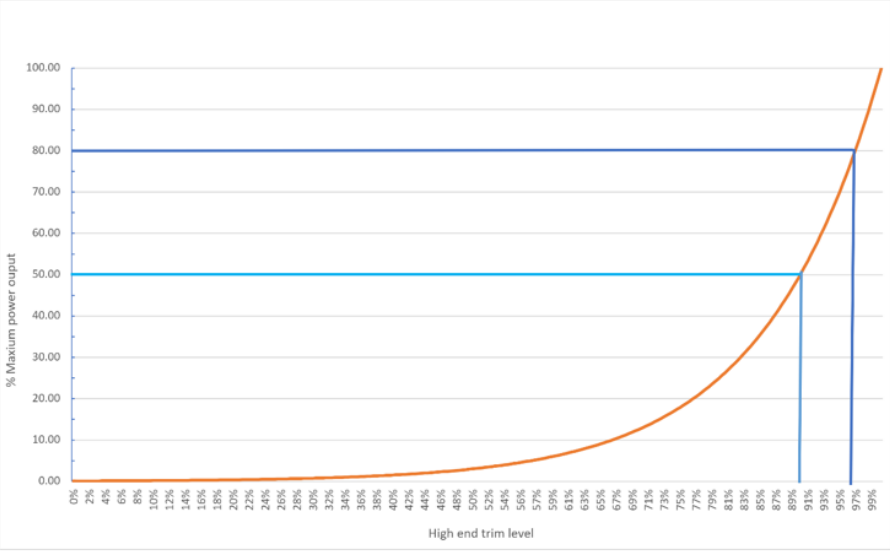
9.10. High end trim

The high end trim feature sets the new maximum value for dimming level and proportionally scales down the rest of the values such as task, background and vacant level. This includes any manual dimming or scene levels.

If the high end trim value is 90%, then 90% is the new 100% dim level and all other values are also scaled down to 90% of their original value.

When high end trim is adjusted using the Interact Pro app, the visual perception of the resulting power output of the lights dims “linear to the eye”, but the actual power output changes exponentially.

To use high end trim to reduce a specific amount of output power, use the graph below that depicts the relation between high end trim level and output power. For example, you must set the high end trim level to 90% to achieve a 50% output power reduction.



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