SMART

MADE IN THE UK

Thorlux Lighting

www.thorlux.com/**smart**

WHAT IS SMART? 3

HOW DOES THORLUX SAVE ENERGY THROUGH LIGHTING CONTROLS? 4

MOTIONLINE 6

DAYLIGHT DIMMING TECHNIQUES 8

MANUAL CONTROL 9

SCENE CONTROL 11

ADDITION OF NON-SMART LUMINAIRES 14

LIGHTING CABLE MANAGEMENT 18

PROGRAMMING 22

ENERGY USAGE MONITORING 23

SMART PRESENCE DETECTION GUIDE 24

HOW TO SPECIFY THE SMART SYSTEM 28

COMMISSIONING 30

WHAT IS SMART?

The Thorlux Smart System exploits the latest "Digital Technology" to provide a simple, effective method of lighting control which minimises energy consumption whilst retaining high levels of user comfort.

A discrete sensor integral to the luminaire monitors ambient light and presence controlling output to the correct level, and ensuring that the area is only illuminated when occupied.

Lighting can account for a high percentage of energy consumed within a building, especially if uncontrolled discharge luminaires or old technology switch start fluorescent luminaires are installed.

Savings by the installation of automatic lighting control systems often exceed 70%.

HOW DOES THORLUX SAVE ENERGY THROUGH LIGHTING CONTROLS?

LIGHTING FROM LUMINAIRES

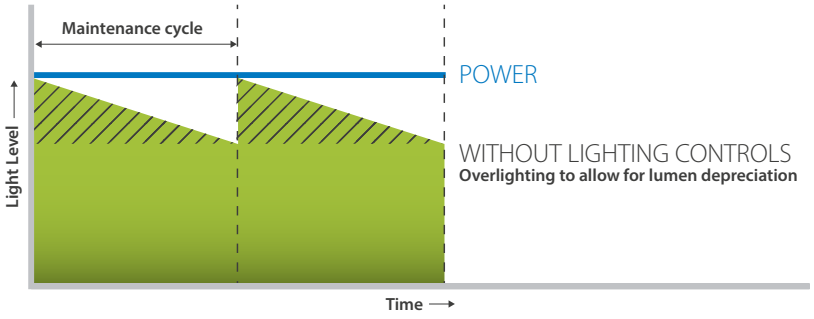
OVER LIGHTING

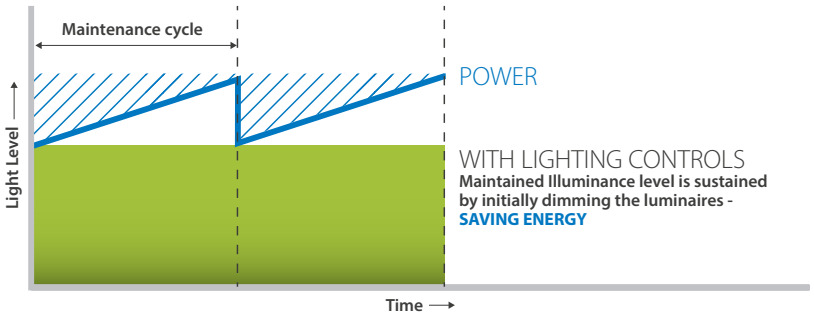
ENERGY SAVED

MAINTAINED ILLUMINANCE

The accumulation of dirt and lumen depreciation cause light loss and uncontrolled schemes are initially "over lit" to compensate. This results in excessive energy consumption over the maintenance cycle.

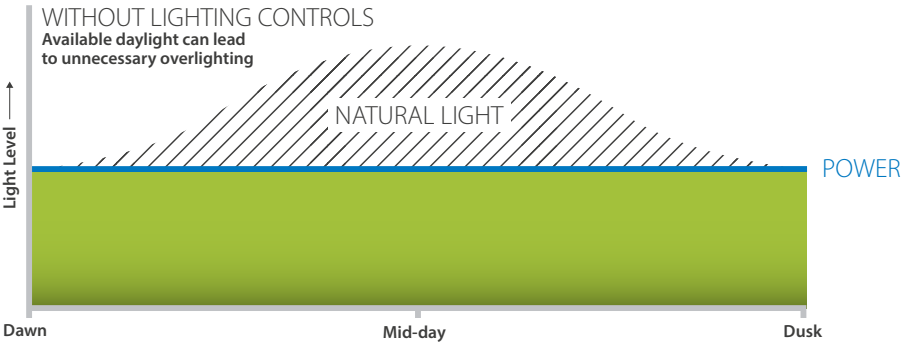
Thorlux lighting controls allow luminaires to be dimmed to the required lighting level therefore avoiding over lighting and reducing energy consumption. This initial lighting level is sustained throughout the maintenance cycle by gradually increasing power, thereby maintaining the correct lumen output.

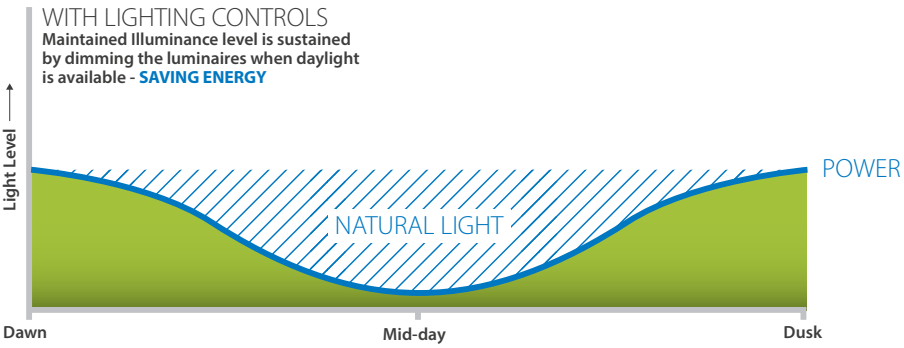




DAYLIGHT DIMMING

When daylight enters a room the lighting controls take this light into account and gradually dim the luminaires, saving energy whilst maintaining the required light level. As daylight increases, luminaire output decreases and luminaires may even switch off, therefore reducing energy consumption. The result is further savings in addition to those achieved by maintained illuminance (see above).



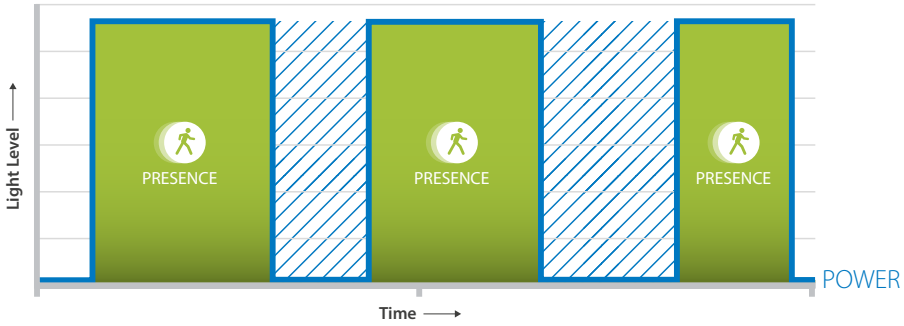


HOW DOES THORLUX SAVE ENERGY THROUGH LIGHTING CONTROLS?

PRESENCE DETECTION

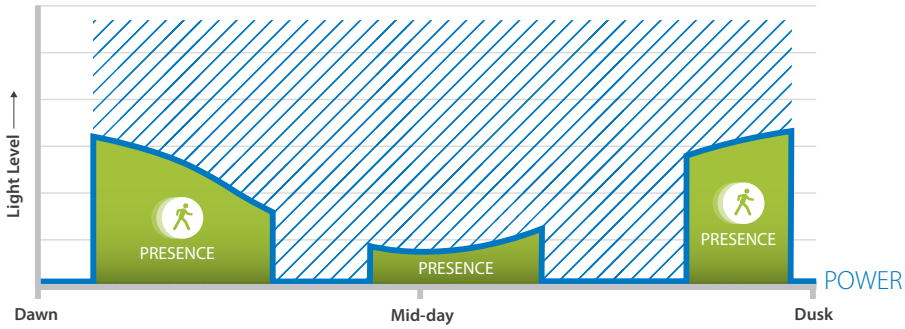
Passive Infra-Red (PIR) sensors are used to detect movement to turn the luminaires on. After a predetermined time of no movement the luminaires will turn off, saving energy.

Some PIRs can be programmed for "absence" mode whereby the luminaires are not initially turned on automatically by movement, but manually by the user with a switch; the PIR will then monitor movement to turn the luminaires off automatically after a pre-determined time.



COMBINE ALL THREE FOR MAXIMUM SAVINGS

Lighting controls that combine maintained illuminance, daylight dimming and presence detection will maximise energy savings, in some instances in excess of 70%. When the area is occupied the luminaire output will be reduced due to levels of ambient light. Even during the short winter days there can be sufficient daylight for the luminaires to dim, providing energy savings throughout the year. Thorlux Smart controls provide energy savings by combining maintained illuminance, daylight dimming and presence detection in a system that can be tailored to suit requirements.



MOTIONLINE

Motionline is a 2-core low voltage connection between Smart luminaires enabling the creation of control groups. If any single luminaire detects movement all connected luminaires within the group will illuminate.

This valuable feature is designed to eliminate the possibility of a user being isolated in a small pool of light, surrounded by intimidating darkness. The Motionline ensures that there will always be a well lit comfortable environment. Once the last person leaves an area the luminaire waits for a pre-programmed period before turning off or dimming to a user pre-defined level.

WITH MOTIONLINE

With Motionline a group of luminaires can be turned on when any one sensor detects movement.

WITHOUT MOTIONLINE

Without Motionline each luminaire will only turn on if a person is within its immediate area.

SMART WIRED MOTIONLINE

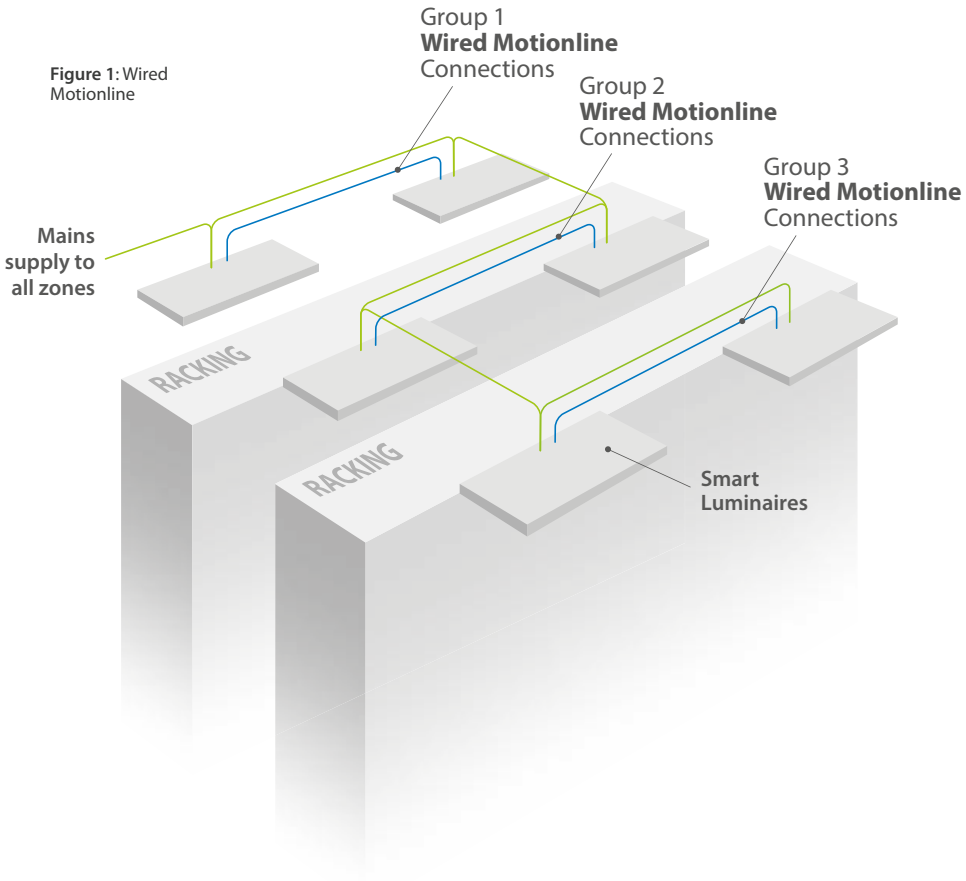
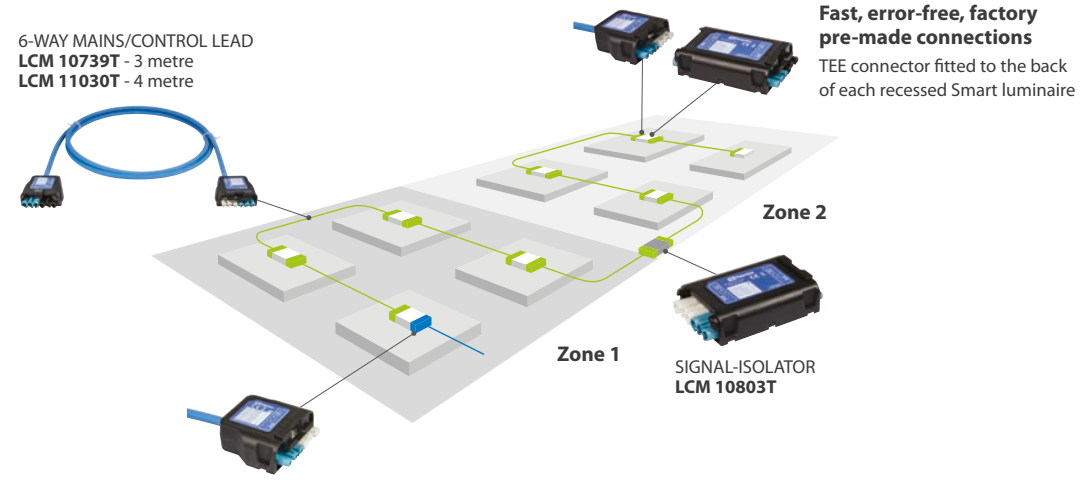


Figure 1: Wired Motionline

SMART MODULAR WIRED MOTIONLINE

Figure 2: Modular wiring



Recessed Smart luminaires are modular wired using 6-core leads.

DAYLIGHT DIMMING TECHNIQUES

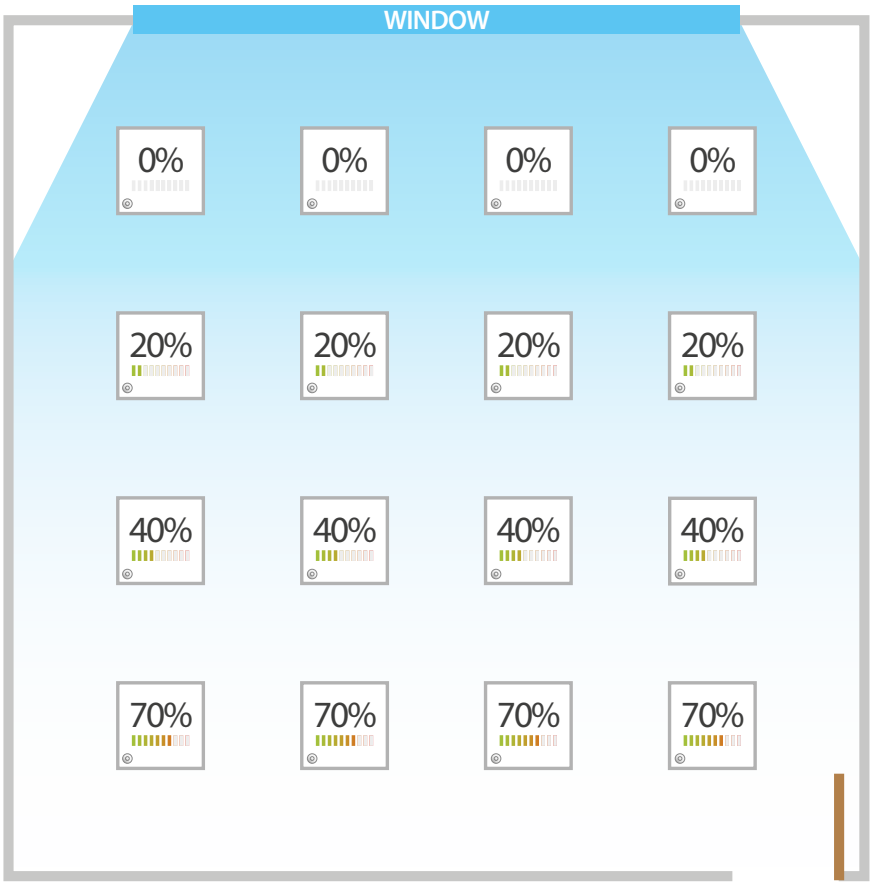
DAYLIGHT LINKING WITH SMART

A light sensor in every luminaire controls the output to suit local ambient conditions. To meet the needs of individual users, or the requirements for the space, each luminaire's factory default settings can be altered using the Smart Programmer.

Each luminaire in the Thorlux Smart System measures and adjusts independently according to the ambient light in its immediate surroundings. This provides good uniformity across the working plane and maximises energy savings where the natural daylight ingress is varied across the area.

BRIGHT-OUT FEATURE

In the event of excess natural light for more than 10 minutes, the individual Smart luminaire will turn off, saving further energy and prolonging the life of the luminaire.



Smart Sensor in every luminaire

Manual control of lighting may be required, either to provide a dimming option as well as switching, or to override any automatic settings should the need arise.

In its simplest form manual control offers the ability to switch the luminaires on or off by switching the live supply. As luminaires become more intelligent, the variety of manual control options also increase.

Any number of retractive switches can be connected to the Motionline to provide group dimming control of Smart luminaires. In normal operation each Smart luminaire will automatically adjust its own luminance level to maintain the preset required light level. When controlled via the switch all the luminaires will initially synchronise to the same lighting level which can then be varied from 100% to 1% (some ballasts are limited to 10%) and off.

Once the area is vacated and the installation has subsequently turned off, the system will revert to automatic mode. Automatic mode can also be reselected by one single momentary press of the switch. Luminaires can also be re-programmed for absence detection. Use of the switch is required to turn on, but if the room is left unoccupied the luminaires will automatically turn off after the pre-determined time. Any "standard" retractive switch can be used and connected to the Motionline or our ready made modular wiring solution can be selected.

MANUAL CONTROL

The Thorlux Smart-Remote can be used to control individual luminaires or the group as a whole. It provides full control with on, off, dim and brighten features. The Smart-Remote is supplied with a unique, robust wall mounting bracket. A locking key kit **ECO 9724** is available if required.

Simple and flexible scene control is provided by the Smart Touch wall plate which plugs in using an RJ45 connection lead and Modular Wiring Adaptor. Conventionally wired versions are also available. Touch sensitive buttons provide a tactile, user-friendly interface.

Scene control provides tailored switching and dimming of luminaires to suit the specific requirements of the space at that time. For example, if using a projector in a meeting room it may be desirable to turn off the luminaires closest to the screen for extra clarity; other luminaires within the space may then be set to a fixed lighting level and ignore any automatic settings.

A scene command will instruct each luminaire to revert to a pre-programmed light level set during commissioning. Each luminaire can be set to a different light output if required.

Smart luminaires can be set to one of the following parameters for each of the three available scenes:

- Fixed output from 1-100%. Fixed scenes will provide a constant light output and will not adjust with ingress of daylight.
- Automatic output 10-200%. Automatic scenes will still dim with daylight but the light level can be set at a lower or higher level than its commissioned level. For example, a classroom may be set to achieve 300 lux for children's education, the light level can be boosted to 160% to achieve an average of 500 lux if that same classroom is to be used for adult educational needs.
- Off

It may be desirable to switch on feature LED luminaires for effect around the room's perimeter via the Smart Hub.

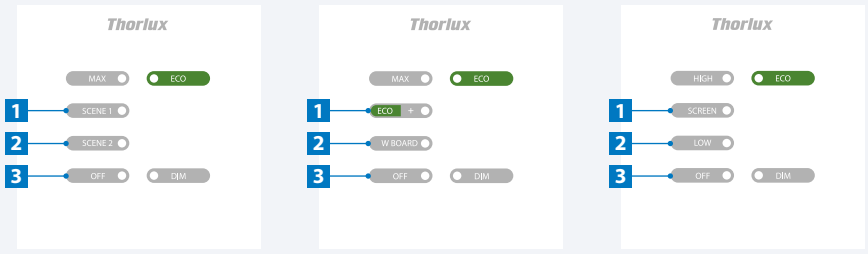
Simple and flexible scene control is provided by the Smart Touch wall plate or Smart Scene remote control handset.

When a particular scene is no longer required another scene can be selected, or by pressing the ECO (automatic) button the system will revert to automatic mode. Alternatively, the system reverts to automatic mode when presence is no longer detected and the time delay has elapsed.

Smart Sensor factory pre-set scenes are set to:
Scene 1 = fixed 50% / 2 = fixed 25% / 3 = off

Smart Hub factory pre-set scenes are set to:
Scene 1 = ON / 2 = ON / 3 = OFF

Smart Touch wall plate options



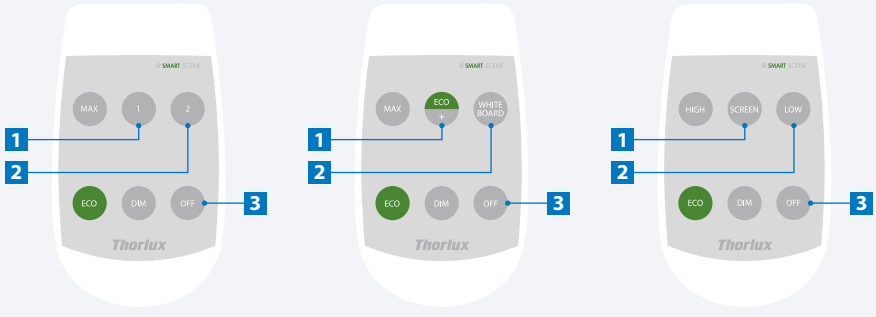
regular *teaching* *meeting*

1 Scene 1

2 Scene 2

3 Scene 3

Smart Scene handset options



regular *teaching* *meeting*

EXAMPLE OF SMART SCENE CONTROL

Unlimited Smart Touch kits or Smart Scene handsets can be used in one area. When the room is vacated and after the luminaires have automatically turned off, the system reverts to ECO mode. All Smart parameters can be adjusted to suit individual requirements using the Smart Programmer.

All luminaires go to their maximum level. Feature lighting switches on.

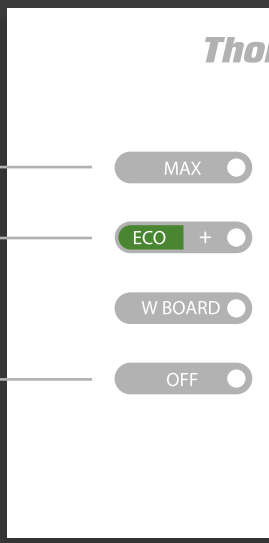
Scene 1

Smart luminaires boost to maintain 500 lux. Ideal for art classes, technology or adult education. Feature lighting, if used, switches off.

Scene 3

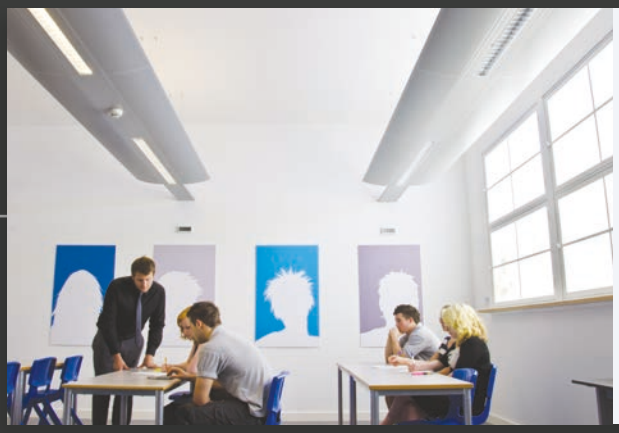
All luminaires turn off *

** Factory default "off" can be re-programmed to suit.*



Teaching Version

EXAMPLE OF SMART SCENE CONTROL



Maintained level, in this example commissioned at 300 lux, feature lighting, if used, switches off. Maximum energy saving mode.

rlux

ECO

DIM

Scene 2

Smart luminaires adjacent to the teaching wall dim to 25% of the maintained ECO level, the luminaire closest to the whiteboard turns off. Others remain at the same setting. Feature lighting, if used, can switch on to highlight wall art.

Brightens or dims Smart luminaires manually to achieve desired level.

ADDITION OF NON-SMART LUMINAIRES

Feature and accent lighting often consists of low power, directional luminaires that are used to highlight features or "break up" a space. These luminaires are generally not suited to integral controls such as Smart.

IT IS POSSIBLE TO ADD NON-SMART LUMINAIRES IN LINE WITH THE SMART SYSTEM:

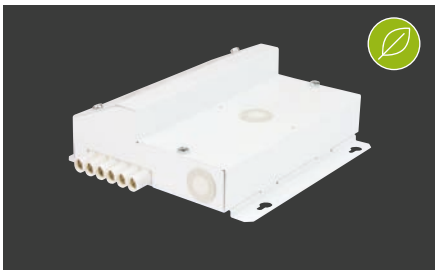
USE OF A SMART HUB TO CONTROL NON-DIMMING LUMINAIRES SUCH AS ACCENT LIGHTING

In many cases the majority of the area will be lit using Smart luminaires with integral automatic controls, having the ability to turn off when the space is vacated. Installing the feature luminaires as "slaves" that switch off and on in line with the Smart luminaires (but will not dim), removes the need for switches and ensures a fully automatic lighting installation.

SUITABLE LUMINAIRES

- Luminaires must be fitted with standard control gear (suffix Thorlux luminaire catalogue number with "L").

Smart Hub



ADDITION OF NON-SMART LUMINAIRES

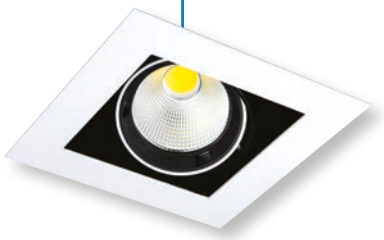
Optional for scene control - Smart Touch wall plate (Hub type) plugs directly into Smart Hub - supplied complete with 6m RJ45 connection lead.

Smart Hub modular wired

3-way Hub extension lead (3m - **LCM 14823**)

3-way Hub extension lead (3m - **LCM 14823**)

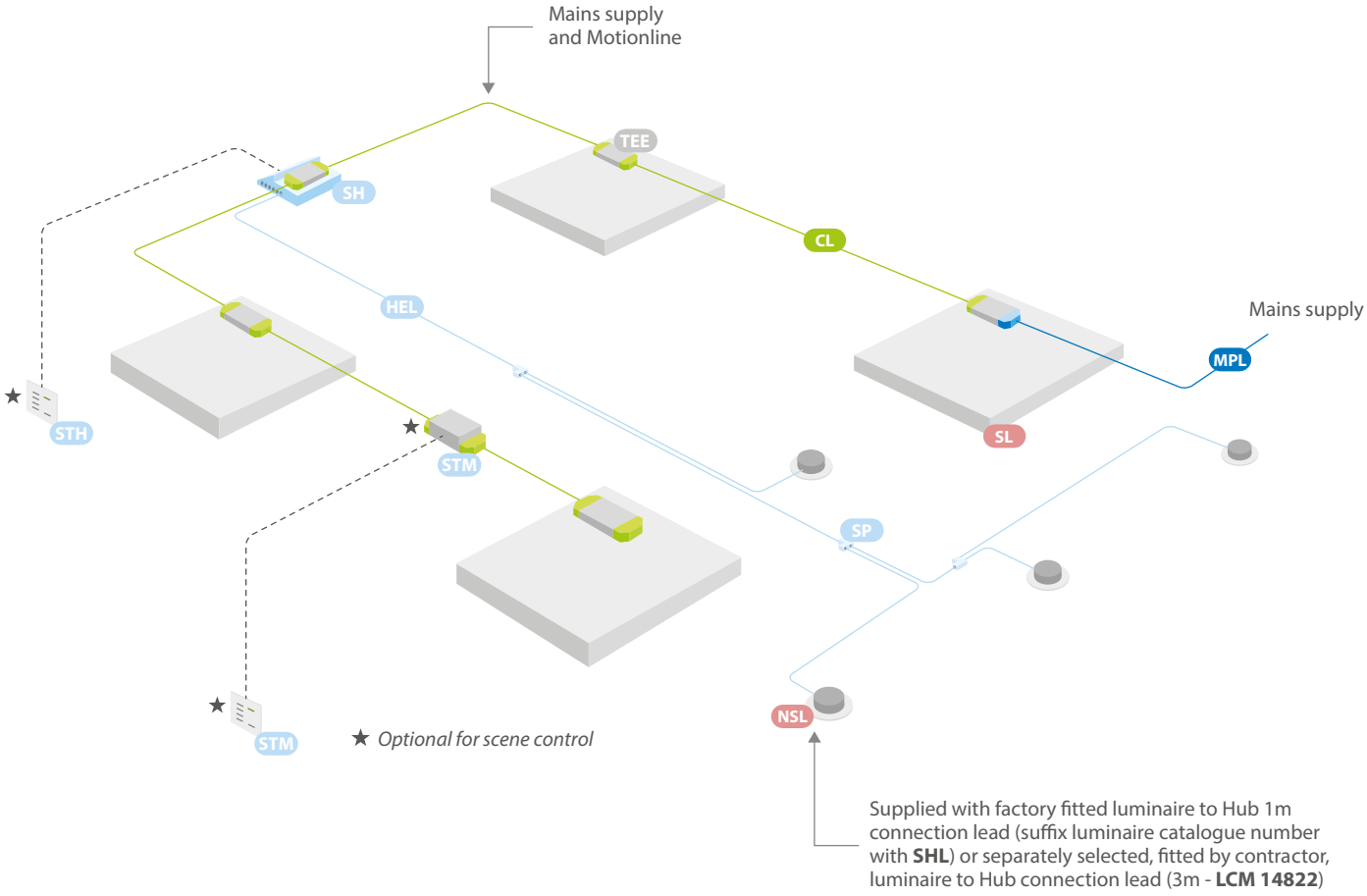
Circuit splitter (**LCM 14928**)



Non-Smart luminaires can be plugged into the Smart Hub using a factory fitted 1m connection lead (suffix luminaire catalogue number with **SHL**) or with a separately selected luminaire to Hub connection lead (3m - **LCM 14822**). Extension leads are available (3m - **LCM 14823**).

ADDITION OF NON-SMART LUMINAIRES

MODULAR WIRING APPLICATION WITH SMART HUB



SH **Smart Hub** *(LCM 14720TEE)*

STH **Smart Touch kit (Hub type)**
(Regular - LCM 14920)
(Teaching - LCM 14921)
(Meeting - LCM 14922)

STM **Smart Touch kit (Modular type)**
(Regular - LCM 14810)
(Teaching - LCM 14811)
(Meeting - LCM 14812)

SP **Circuit splitter** *(LCM 14928)*

HEL **Hub extension lead** *(LCM 14823)*

MPL **6-pole mains plug with 4-core input lead** *(3m - LCM 12749T)*

CL **1.5mm² (CSA) Mains/control lead (6-pole)**
(3m - LCM 10739T)
(4m - LCM 11030T)
(6m - LCM 11003T)

SL **Smart luminaire**

NSL **Non-Smart luminaire**

TEE **TEE connector** - *fitted to back of all Smart luminaires*

Mains and Motionline 6-core

Mains switched 3-core, maximum distance 100m

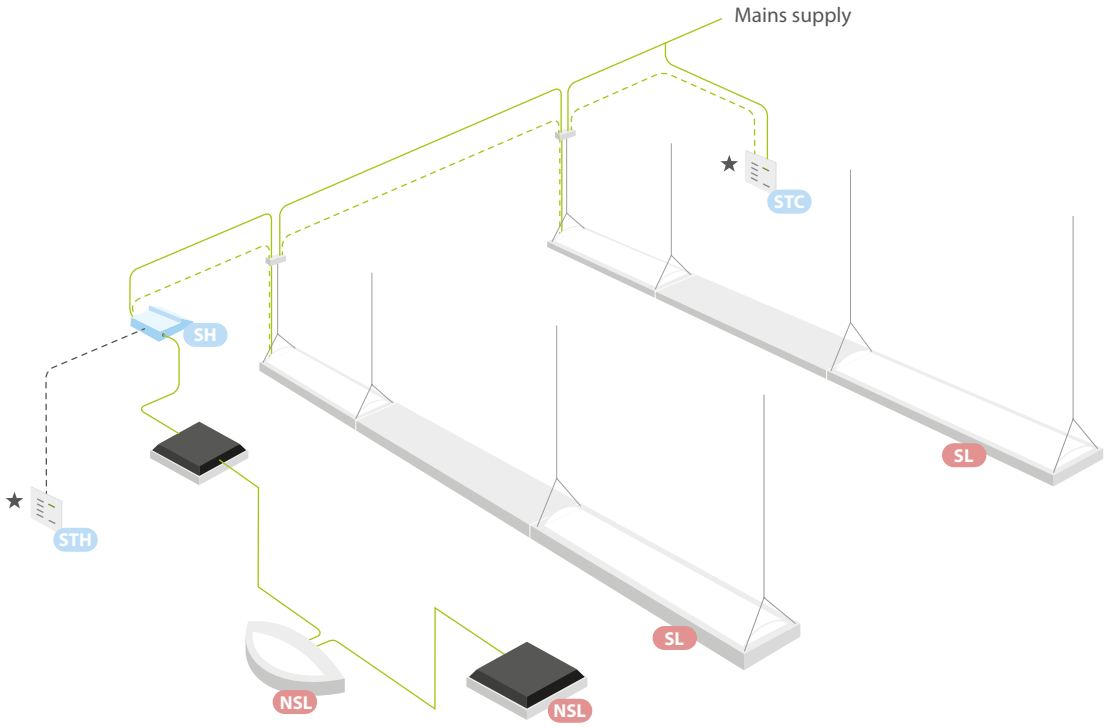
Maximum 20 Smart luminaires *(max 5A)*

Maximum of 5A total load on Smart Hub *(fused internally)*

Maximum combined system current 5A

ADDITION OF NON-SMART LUMINAIRES

CONVENTIONAL WIRING APPLICATION WITH SMART HUB



★ *Optional for scene control*

SH **Smart Hub** *(LCM 14720)*

STH **Smart Touch kit (Hub type)**
(Regular - LCM 14920)
(Teaching - LCM 14921)
(Meeting - LCM 14922)

STC **Smart Touch (Conventional wiring type)**
(Regular - LCM 14813)
(Teaching - LCM 14814)
(Meeting - LCM 14815)

SL **Smart Luminaire**

NSL **Non-Smart Luminaire**

Mains

2 wire Motionline

Maximum 20 Smart luminaires on one mains circuit

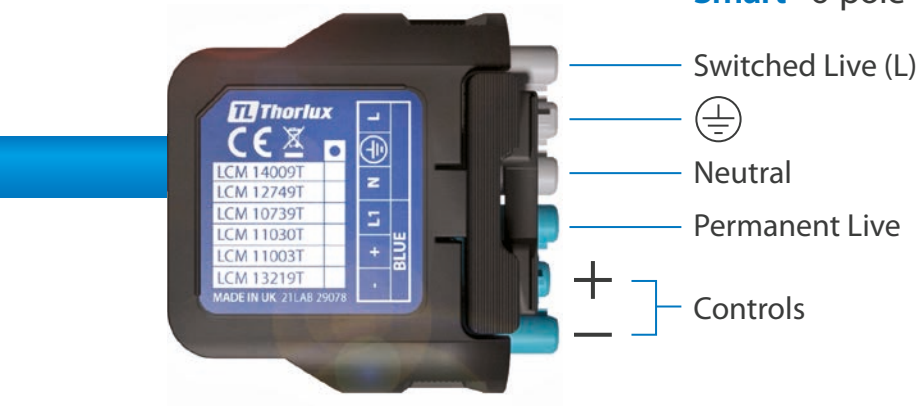
Maximum 50 Smart luminaires on one Motionline group

Maximum of 5A total load on Smart Hub *(fused internally)*

LIGHTING CABLE MANAGEMENT

Recessed Smart luminaires are manufactured with fitted "plug and play" TEE connectors to accept factory made and tested interlink leads.

This approach, often referred to as modular wiring, provides a fast, error free installation and overall lower total system costs. A range of additional lighting control components can easily be added to the system to customise the installation to the user's requirements.



Smart - 6-pole

- Switched Live (L)
- ⏚
- Neutral
- Permanent Live
- \+ / – Controls

SPECIFICATION

- Thorlux UK designed and manufactured
- LS0H - low smoke zero halogen cables
- Leads can be plugged together to extend wiring
- Future flexibility - plug and play
- Twin latch design - strong strain relief
- Constructed from flame retardant nylon
- Compliance with new standard BS EN 61535:2013

NOTE: If modular wiring is not required please suffix luminaire catalogue number with **NT** e.g. **XL 18306DNT**

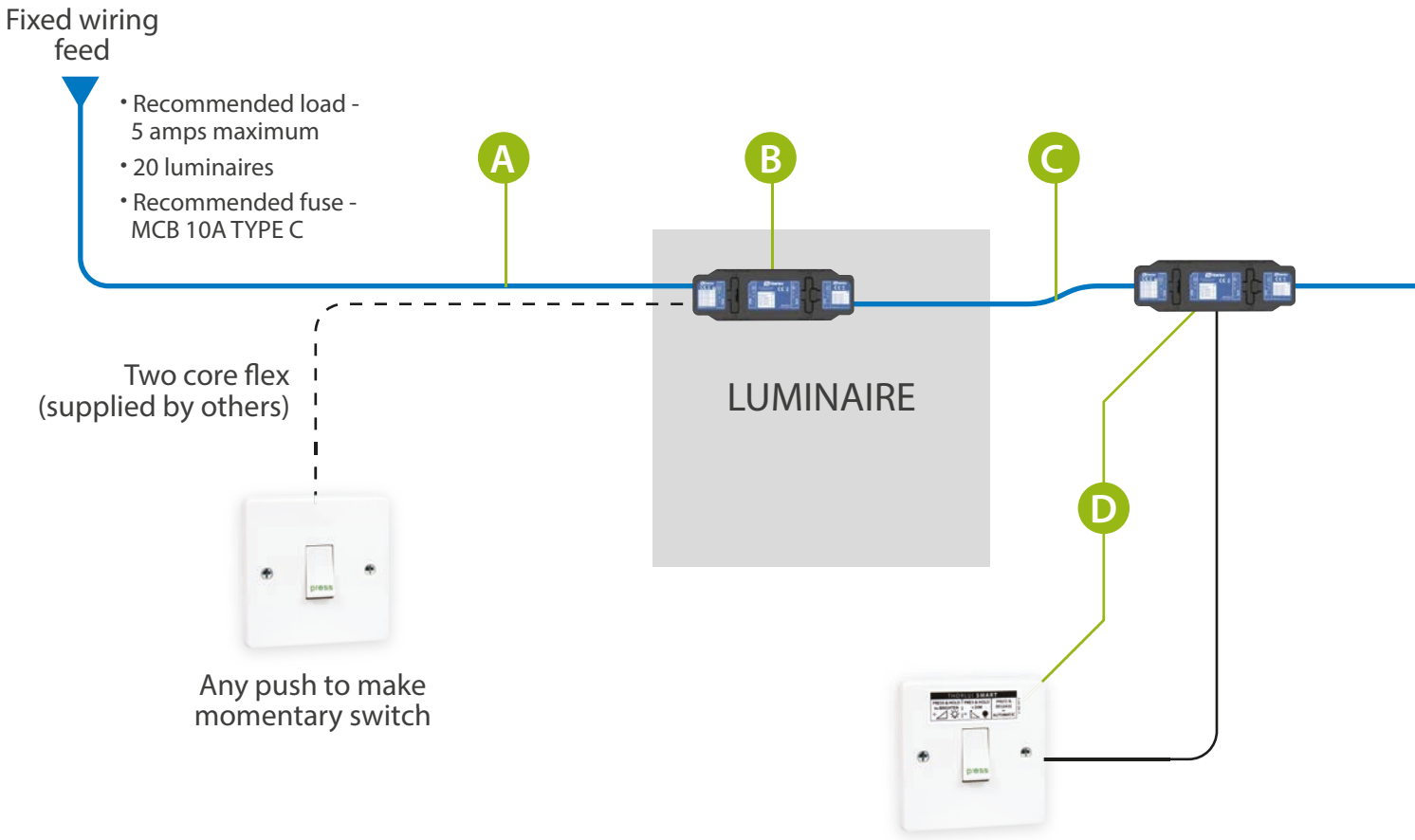
LIGHTING CABLE MANAGEMENT

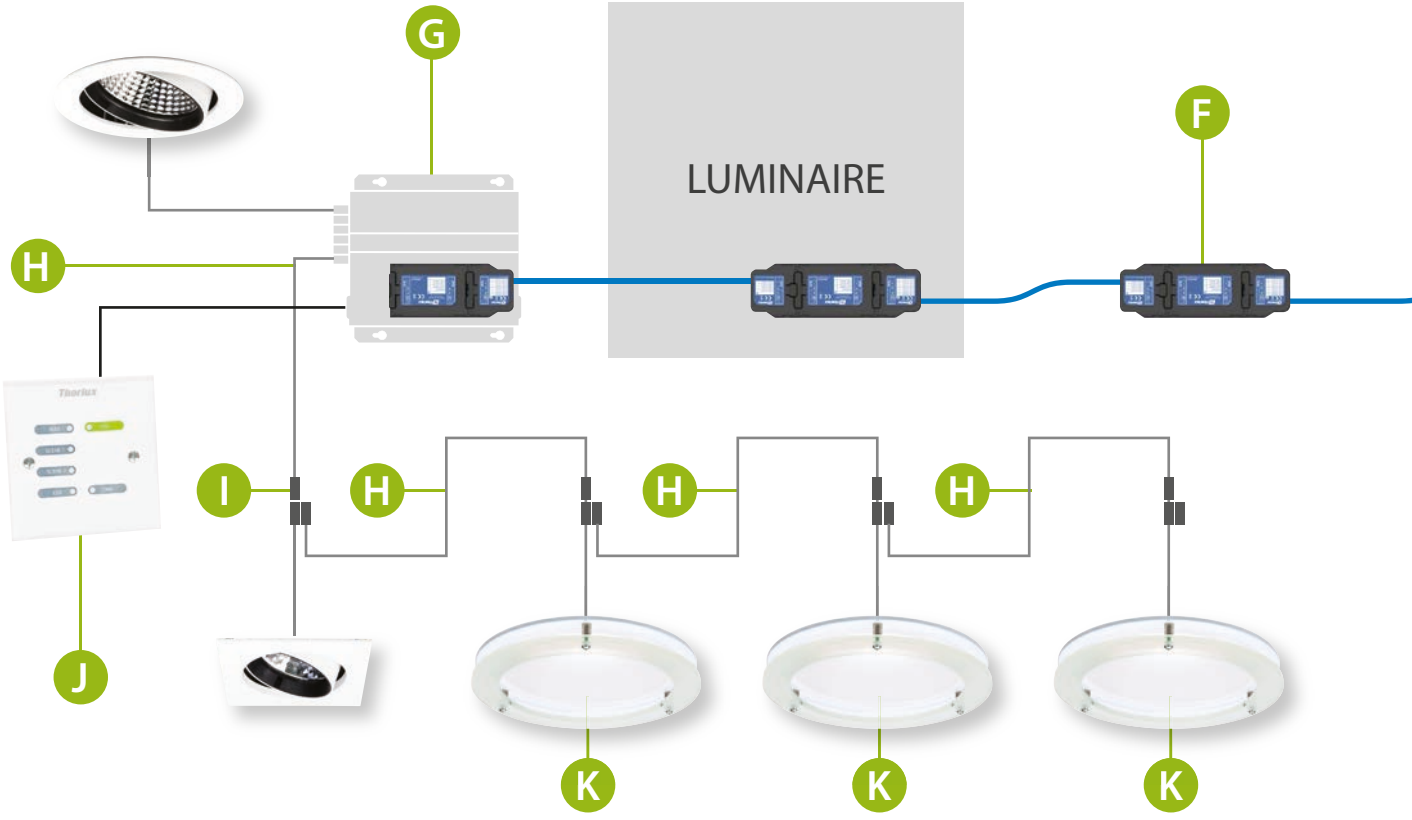
LS0H - low smoke
zero halogen cables

Twin latch design -
strong strain relief

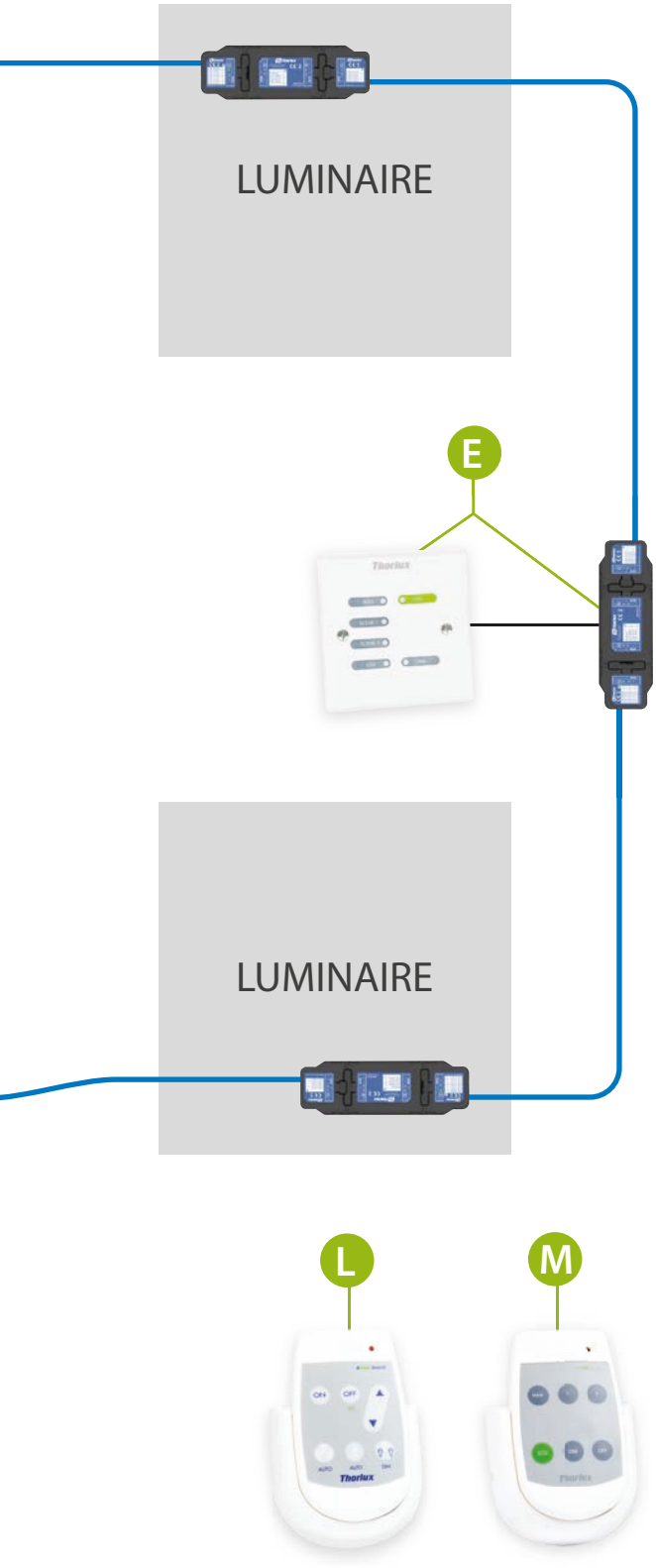
Constructed from
flame retardant nylon

TYPICAL MODULAR WIRING EXAMPLE





TYPICAL MODULAR WIRING EXAMPLE



RANGE

REF	DESCRIPTION	CAT. No.	APPROX. kg
A	Starter lead - 6-pole mains plug with 4-core input cable stripped at one end 1.5mm² - **3m**	**LCM 12749T**	0.39
B	Factory fitted 6-pole TEE connector (suffix Thorlux luminaire catalogue number with **TEE**)		
C	Connection lead - 6-pole connectors with 6-core cable 1.5mm² - **3m**	**LCM 10739T**	0.61
C	Connection lead - 6-pole connectors with 6-core cable 1.5mm² - **4m**	**LCM 11030T**	0.78
C	Connection lead - 6-pole connectors with 6-core cable 1.5mm² - **6m**	**LCM 11003T**	0.95
D	Wall Switch Kit (RJ45 lead - **6m** supplied)	**LCM 14010T**	0.25
E	Smart Touch kit (Modular Wiring Type) - **Regular** (RJ45 lead - **6m** supplied)	**LCM 14810**	0.41
E	Smart Touch kit (Modular Wiring Type) - **Teaching** (RJ45 lead - **6m** supplied)	**LCM 14811**	0.41
E	Smart Touch kit (Modular Wiring Type) - **Meeting** (RJ45 lead - **6m** supplied)	**LCM 14812**	0.41
F	Signal-Isolator	**LCM 10803T**	0.2
G	Smart Hub (Modular Wiring Type)	**LCM 14720TEE**	0.97
H	Hub extension lead - 3-pole connectors with 3-core cable 1.5mm² - **3m**	**LCM 14823**	0.16
I	Circuit splitter	**LCM 14928**	0.02
J	Smart Touch Kit (Hub Type) - **Regular** (RJ45 lead - **6m** supplied)	**LCM 14920**	0.21
J	Smart Touch Kit (Hub Type) - **Teaching** (RJ45 lead - **6m** supplied)	**LCM 14921**	0.21
J	Smart Touch Kit (Hub Type) - **Meeting** (RJ45 lead - **6m** supplied)	**LCM 14922**	0.21
K	Luminaire factory fitted with a 1m Smart Hub lead and circuit splitter (suffix Thorlux luminaire catalogue number with **SHL**)		

L	Smart-Remote infra-red handset	**LCM 13479B**	0.08
M	Smart Scene handset - **Regular**	**LCM 14816**	0.08
M	Smart Scene handset - **Teaching**	**LCM 14817**	0.08
M	Smart Scene handset - **Meeting**	**LCM 14818**	0.08

For full details of wiring systems and lighting control products visit **www.thorlux.com/controls**

PROGRAMMING

Each Smart luminaire can be individually programmed ensuring that the lighting installation is tailored not only to meet the needs of the users but to also maximise energy savings.

Factory default settings can be adjusted when required, so the lighting may be reconfigured if the use of an area changes.

Whilst Thorlux Smart Systems are designed to operate with factory default settings "straight from the box" Thorlux strongly recommends on site commissioning to ensure optimum energy saving and user convenience.

ENERGY USAGE MONITORING

Lighting accounts for approximately one fifth of the planet's electrical energy usage, therefore installing intelligent lighting controls can result in large savings. However, installing equipment to monitor this load can be expensive.

Smart luminaires have in-built energy usage monitoring capability.

SMART

Monitoring information can be read back from each luminaire independently using the Smart Programmer providing valuable maintenance and energy usage data.

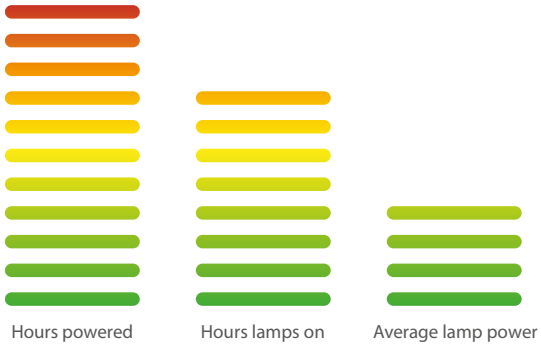
POWER MONITORING CAPABILITY

Smart Sensors monitor and record certain operating parameters which can be retrieved for analysis to provide maintenance and energy usage information.

The Smart System will provide data for individual luminaires.

Non resettable	Total time connected to mains (hours)
Resettable *	Time connected to mains (hours) Lamp switched on time (hours) Lamp on average power level (%)

* 4500 hours maximum recording time (lamp on)



SMART PRESENCE DETECTION GUIDE

The Thorlux Smart system uses a passive infra-red (PIR) movement sensor built into each luminaire. Infra-red sensing is a commonly used technology for lighting control, but it is important to consider a few factors in order to get the best performance from the luminaires.

PRESENCE DETECTION OF THE SENSOR

There are two different sensors available:

For internal use
Standard Smart Sensor – for use up to 8m
High Level Smart Sensor – for use up to 18m

MOTIONLINE

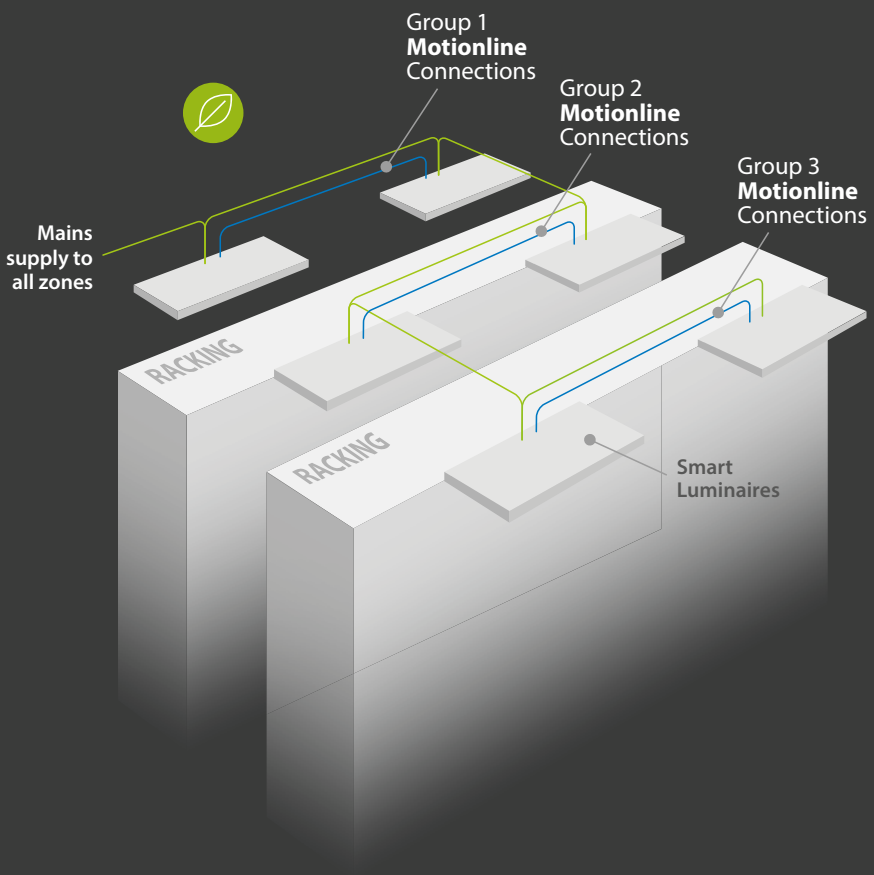
It is strongly recommended Smart luminaires are connected using the "Motionline" two-core low voltage bus. If one luminaire detects movement, a signal is passed to all of the luminaires in the group triggering all luminaires to illuminate. This ensures effective group control and extends presence detection coverage.

MOUNTING HEIGHT

As the mounting height increases, so does the amount of movement needed to trigger the sensor. Hand movement may not be sufficient for sensors mounted higher than 6m therefore the person may need to be walking to be detected.

POSITIONING OF THE SENSORS

Where possible, Smart luminaires should be positioned in such a way that the detection areas overlap. The Smart system has a sensor in each luminaire ensuring that the optimum detection level is easily achieved using conventional spacing.



STANDARD SMART SENSOR

MOUNTING HEIGHTS UP TO **8m**

AMBIENT TEMPERATURE SENSOR

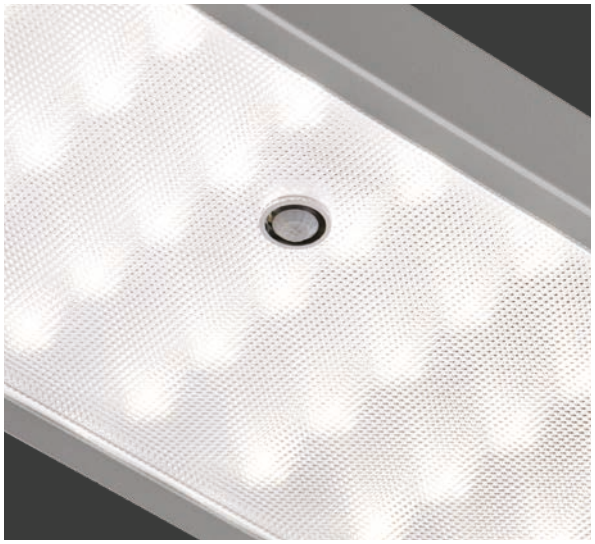
In order for movement to be detected, the PIR sensor requires the moving object to have a temperature differential of at least 4°C from the surrounding area. In a typical indoor application there is sufficient difference between a person, with a typical external skin temperature of 32°C (measured on the head or hands), and the surrounding ambient temperature of 20°C. However, as the ambient temperature rises or falls there are certain factors to consider:

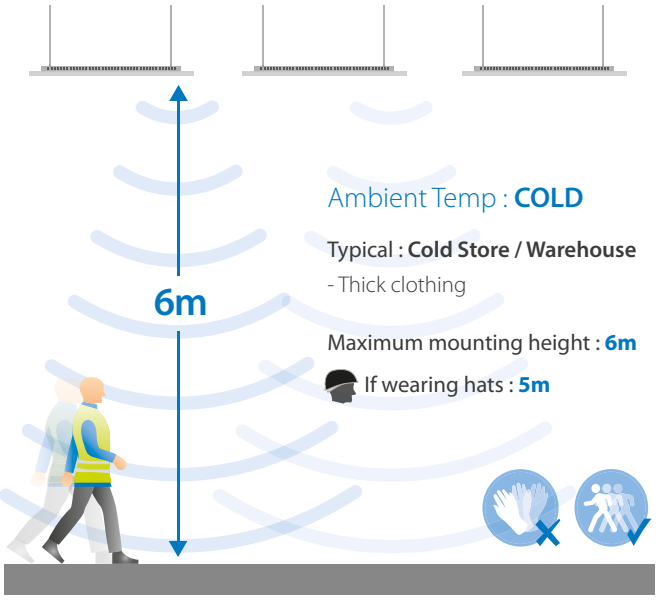
LOW AMBIENT TEMPERATURE

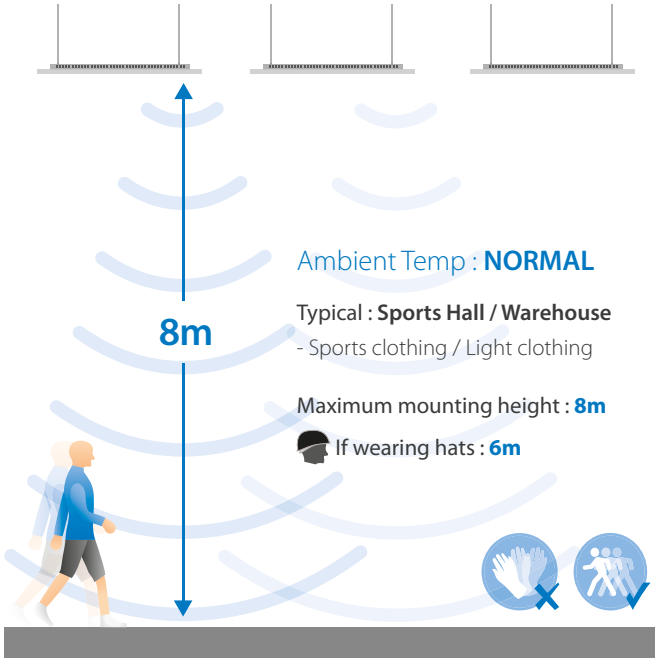
In low temperature applications personnel often wear insulating clothing. This can reduce the thermal image presented to the sensor reducing its effectiveness.

HIGH AMBIENT TEMPERATURE

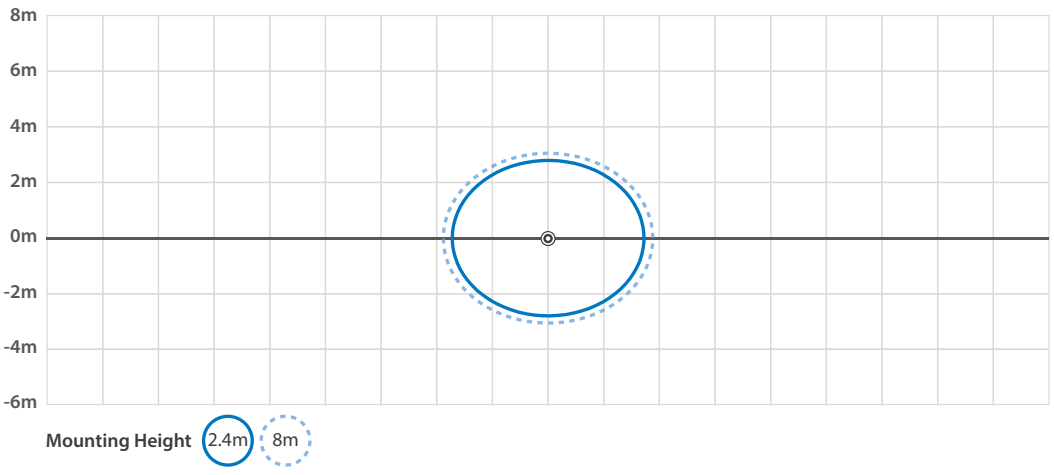
In higher ambient temperature applications (>30°C) the sensitivity may be reduced as the differential between ambient and body temperatures is reduced.







Smart Sensor - Detection Area



HIGH LEVEL SMART SENSOR

MOUNTING HEIGHTS UP TO **18m**

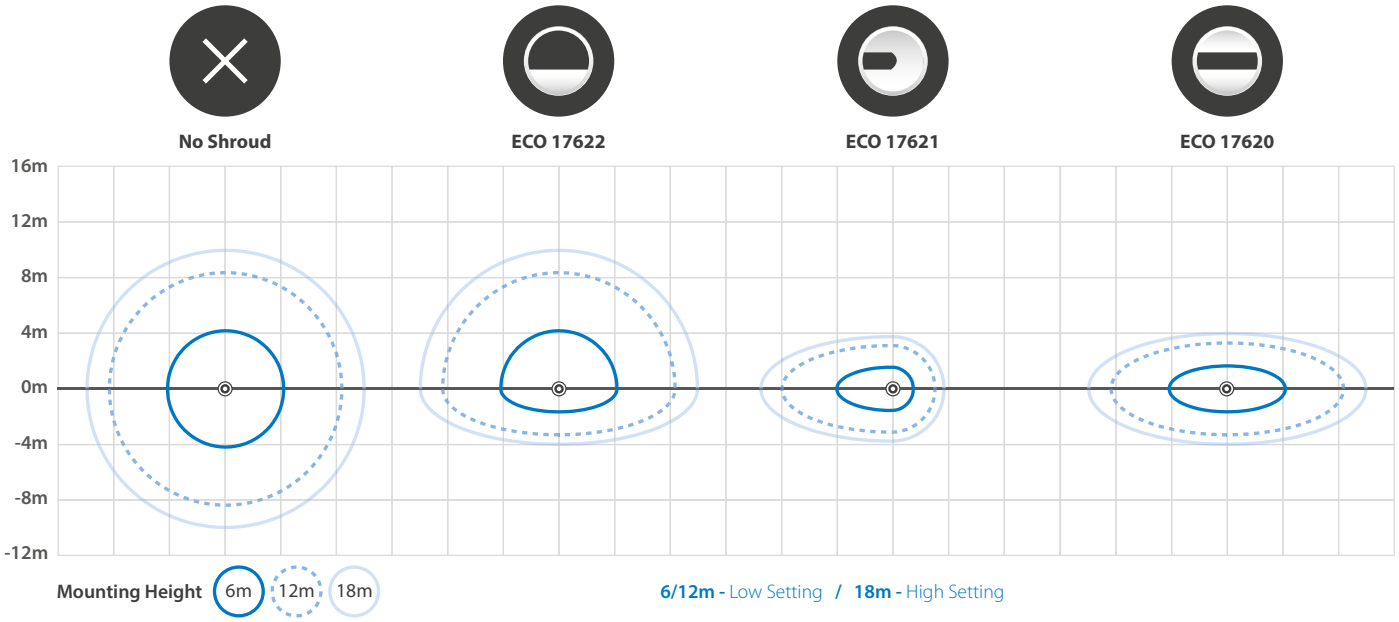
The High Level Smart Sensor is optimised for mounting heights up to 18m. An adjustable lens allows for the detection area to be tuned to suit the application perfectly, with the lens at the "high" setting for all applications above 12m. All Smart settings can be configured from ground level using the Smart Programmer.

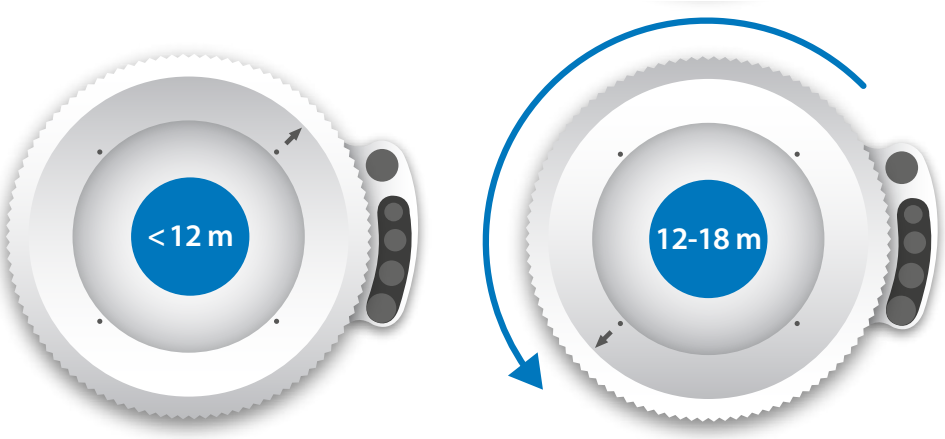
Optional shrouds can be fitted to the High Level Smart Sensor to restrict the detection area if required. For example, ECO17620 could be used in racking areas to avoid detecting movement in adjacent aisles.

For best presence detection it is recommended that luminaires are grouped using Motionline.

For more information see **www.thorlux.com/smart**

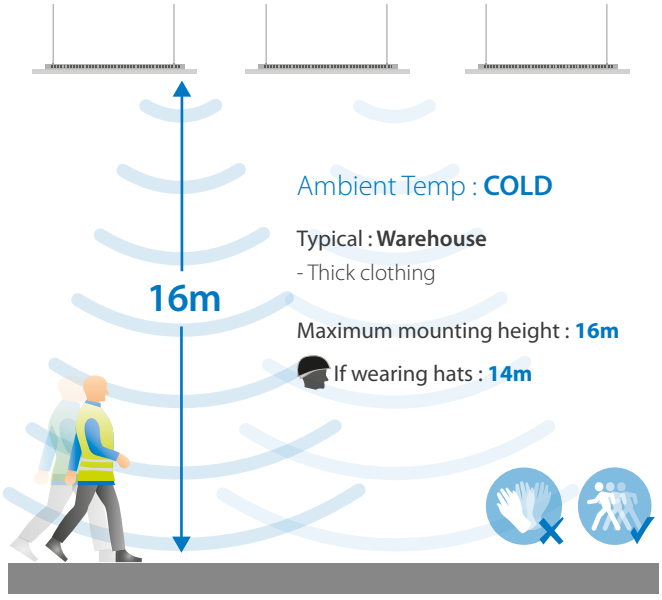
High Level Smart Sensor - Detection Area

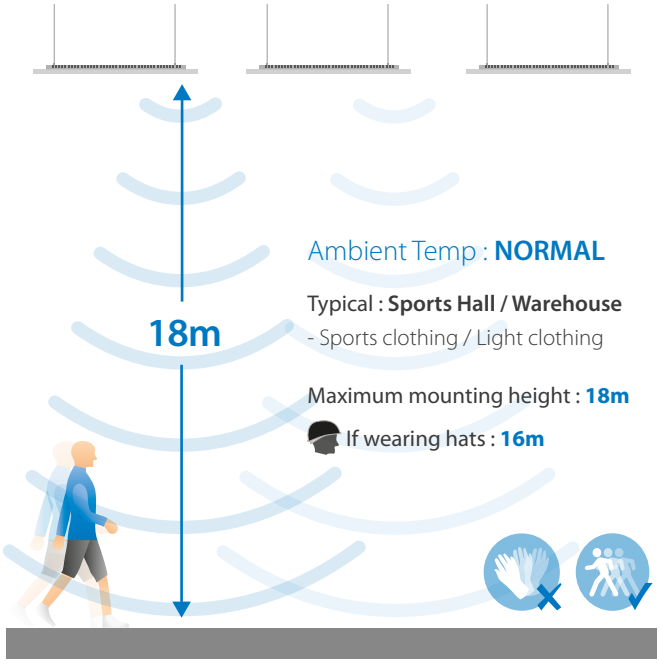




HIGH LEVEL SMART SENSOR

MOUNTING HEIGHTS UP TO **18m**





HOW TO SPECIFY THE SMART SYSTEM

SHORT SPECIFICATION TEXT

Intelligent luminaire fitted with integral Smart Sensor providing daylight harvesting, maintained illuminance, presence/absence detection and scene setting. The system shall be capable of group presence communication ensuring luminaires can illuminate in groups and with individual scene setting control. Optional 868 MHz wireless mesh connectivity with building wide link address capability. All aspects are programmable from floor level using an infra-red remote control programmer.

FULL SPECIFICATION TEXT

Each luminaire shall be equipped with an "intelligent" electronic sensor providing movement detection, light level sensing and an infra-red receiver for programming and remote control. Luminaires shall be capable of being linked together to form motion groups. Linking shall be possible using a two core bus or wirelessly using an 868 MHz* transceiver. Movement detected by one sensor will be signalled to all other sensors in its group. No bus power supply or other ancillary control devices will be required to facilitate such operation. Sensors shall be capable of "absence" mode operation in conjunction with push to make switch, scene control plate or infra-red handset.

Each sensor shall provide individual dimming of the luminaire and maintain a set illumination level. Grouped dimming shall not be acceptable for daylight control. Sensors shall be fully programmable and reconfigurable using a hand held infra red programmer. The programmer shall be capable of reading back and displaying current sensor settings and power/maintenance monitoring information from individual luminaires. Monitoring can be reset by the user. Sensors to be capable of operating DALI and DSI digital ballasts.

WALL SWITCH CONTROL

Momentary action switches may be connected to the Motionline circuit to enable group dimming and switching control of intelligent luminaires.

"TOUCH" SCENE CONTROL

Sensors shall be capable of responding to scene controls from a wall-mounted, touch sensitive control plate or a hand-held remote controller. Each sensor shall be individually programmed and reconfigurable for each scene.

The system shall be capable of setting either fixed scenes which are a percentage of full output, or automatic scenes which will maintain an illumination level expressed as a percentage of the standard light level setting.

Scene control plates shall be of the capacitive sensing type. Each function shall have a status LED which will display the current system status. Scene plates shall be printed to suit the application, and matching infra-red remote controllers shall also be available. Remote controllers should be supplied with wall brackets and optional locking mechanisms.

Each control group shall be capable of using multiple scene control plates and its current setting will automatically display on all scene plates. When the area is vacated the whole system should automatically revert to "ECO" energy saving mode.

MODULAR WIRING

Recessed luminaires shall be supplied complete with a 6-way modular wiring TEE connector to include an unswitched and switched mains supply. Interconnecting leads shall be used to provide rapid installation and flexibility for future modifications to the system. Leads shall be factory tested for circuit continuity/polarity and high voltage tested for insulation quality.

Interconnecting leads shall use LSOH cables and comply with BS EN 61535:2013. Connections between leads and luminaires shall have twin latch.

CONVENTIONAL WIRING

Luminaires shall have a two-pole terminal block for connection of the Motionline link between luminaires.

ADDITION OF NON-INTELLIGENT "SLAVE" LUMINAIRES

The system shall be capable of switching non-intelligent "slave" luminaires based upon movement detection of the main group of intelligent luminaires and shall be capable of being reconfigured for all conditions - i.e. normal (automatic/ECO) operation, scene and vacant conditions.

ENVIRONMENTAL CREDENTIALS

The manufacturer shall be independently certified to ISO14001. The manufacturer's processes shall be carbon offset via a quantifiable carbon offsetting scheme and shall include emissions from the lighting manufacturer's vehicles used for delivery and other project associated mileage.

** 922 MHz for Australasia*

COMMISSIONING

Thorlux Lighting designs, manufactures and supplies the most energy efficient lighting systems on the market. The majority of Thorlux products can be used straight from the box with their default settings. However, to operate most effectively, products need to be configured to the conditions on site (and also in line with any specific user wishes). Thorlux has a team of skilled commissioning engineers who can visit the site and configure the lighting installation upon request. Commissioning is charged at a daily rate and will be added to most project quotations as a standard option.

COMMISSIONING SERVICE

Thorlux offers a professional on-site commissioning service to ensure that Smart products are configured to provide the desired performance and return on investment. Commissioning begins with identifying the end-user's project requirements and ends with ensuring that the installed systems satisfy these requirements.

Commissioning of lighting is now an integral part of the requirements for new buildings and major refurbishments under Building Regulations. Paragraph L1(b)(iii) of Schedule 1 to the Building Regulations requires fixed building services to be commissioned by testing and adjustment as necessary to ensure that they use no more fuel and power than is reasonable in the circumstances.

Thorlux offers a full on-site commissioning and maintenance service using our own, highly qualified engineering team.

All engineers are Thorlux trained and hold all relevant industrial qualifications, including:

- **PASMA scaffold certification**
- **IPAF powered access operation such as scissor and boom lifts 3A and 3B**
- **Annual asbestos awareness training**
- **CSCS skills card**
- **CIS Electrical Safety card**
- **CBS criminal records check**

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