ActiLume

OEM application guide

PHILIPS

Contents

1 What is ActiLume

ActiLume, is a new easy to install and use, fluorescent lighting dimming system for offices, schools, etc. that offers maximum comfort and automatic energy/ CO_2 savings of up to 75%. ActiLume switches the artificial lights in an office automatically on and off on occupancy and regulates the luminaires (artificial lights) down when enough daylight (natural light) enters the room.

Although the ActiLume system is a revolutionary system intended to be used as a Plug-and-Play system, in some cases it is necessary to do some commissioning (reprogramming) of the system. Commissioning is done by pushing a button on the sensor that will set the artificial light according the architects requested light level or switches the controller from Open Plan Mode to Cell Office Mode. This means installers and end-users do not have to worry about complicated programming anymore.

ActiLume consists of a sensor and control unit to be built in to a luminaire and is ready to be used. The sensor part contains three functions (a light sensor for daylight depending regulation, a movement detector for occupancy control and an infrared receiver for remote control). The lighting can also be controlled manually, either by a wired switch with a single push-to-make contact (Touch and Dim) or with a remote control. The system is operated with Philips HF-REGULATOR TD EII dimmable electronic ballasts. Moreover, the light output of the luminaire is already pre-programmed according to its place (window or corridor side of the office). The light of the corridor side will follow the window side with a 30% offset.

ActiLume is the first truly Plug-and-Play lighting controls system and can be installed in 3 simple steps. At first the luminaires are connected and mounted in the ceiling. Via 2 pushes on the sensor, commissioning can be realised. The first push (a short push of <2 sec) will let you select the application and set the system to either cell or open plan office. The second push, a long push (3 to 4 seconds), is to calibrate the system and set the reference light level of the ActiLume system to the light level as specified by the lighting designer. The system is now ready for use. Therefore complicated commissioning is something of the past. Other applications can be chosen via a remote control.

The European Norm EN 12464 and the building directive 2002/91/CEE stimulate ergonomics and energy saving in the work place. With the Philips ActiLume system you can easily comply with both regulations.

2 Product characteristics ActiLume system

ActiLume consists of the following basic components:

- ActiLume controller (LCC1653/01)
- ActiLume sensor (LRI1653/01)

Additional components are:

- One remote control to make the commissioning easier.
  - The IRT9090/00 for advanced commissioning for all Modes and to change certain default factory values intended for installers and facility managers.
- Three infrared remote control units
  - IRT8010/00
  - IRT8030/00
  - IRT8050/00

  All three are intended for the end users to personalise the light levels with preset dim values, scene setting or manual override of light levels.
- An additional extension sensor (LRM8118/00) to assure movement is detected wherever needed

This chapter will cover the product characteristics of the ActiLume sensor and controller. The remote controls information can be found in Chapter 4 Manual control.

2.1 ActiLume sensor LRI1653/01

The ActiLume sensor has 4 functional devices installed in a housing with a wired connection cable to the controller. The functional devices are:

- Movement detector (PIR)
- Light detector
- Infrared receiver
- Service button

The application area of ActiLume is a typical indoor environment (offices etc.) in normally heated and ventilated areas. ActiLume has no protection against aggressive chemicals or water (pollution degree 2). The sensor is normally mounted inside a Class I luminaire and is optimised for a ceiling height of 2.5 to 3 metre. The mounting height can reach up to 3.5 metre but the sensitivity patterns of the sensors will change accordingly.

2.1.1 Movement detector

The movement sensor is a PIR (Passive Infra Red) sensor that detects occupancy with an X-Y cross-area under an angle of X = 82° and Y = 100°. When installed in a typical office ceiling at 3-metre height, it is sensitive for small movements within a 4 by 4 metre area. It will cover small movements down to a few centimetres at the task area of a desk and is sensitive to large movements within a range of 6 by 5 metre to detect large movements. See also Figure 1.

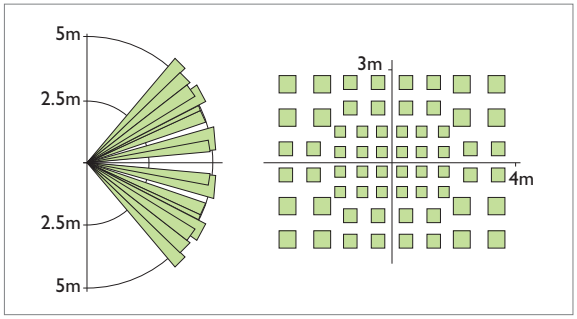


Figure 1

Though the sensor has a radial reach of 5 metre, the maximum recommended height to place the sensor in the ceiling is 3.5 metre to assure movement coverage and detection.

The PIR sensor reacts on movement by means of a temperature difference like the human body temperature versus its surrounding temperature. A car that just starts its engine is not seen by the PIR, nor does it see people sitting within the car or a forklift truck. Therefore it is recommended not to use the ActiLume system in outdoor, parking or industrial applications. The LRM8118/00, which is an extension part to the ActiLume system, is to increase the movement detection range. It has the same viewing specifications as the standard sensor (LRI1653/01). More info on this sensor can be found in Chapter 7.4.1 Extension sensor (LRM8118/00).

2.1.2 No light after mains power is interrupted

ActiLume is preferably never disconnected from the mains and soft-switched by means of movement detection or manually via the Touch and Dim push button or IR remote control.

When ActiLume is hard-switched or if the power supply is interrupted, the ActiLume movement sensor requires a circuit stability time of 15 to 30 seconds after switching on the mains. During this stabilizing period the luminaires are in their default setting (factory setting is OFF). This

is to avoid a complete building is being lit after a power cut during the night or every morning when a complete building or floor is being switch on. This behaviour is called "power-up-state".

The "power-up-state" can be changed to "ON" via the IRT9090/00 commissioning tool and is described in Chapter 5.6 Setting the Power-up state.

2.1.3 Daylight sensor

The daylight sensor is a Light Dependant Resistor (LDR) sensor that reads actual average illuminance in Candela per m^2 captured under an angle of 72°. The intensity of the illuminance depends on the amount of artificial and/ or natural light supply in the office as well as how well this light is reflected towards the ceiling. The light reflection depends highly on the colours chosen to furbish the office and can vary between 0.1 for pure dull black to 0.5 for a complete glossy white furnished office. In an average office the reflection factor is 0.3. The illuminance signal is sent continuously to the controller. The ActiLume controller translates these signals into dimming commands as described in Chapter 2.2.1 LCC1653/01 Controller interaction with daylight supply.

2.1.4 Minimum distance daylight sensor to window

The daylight sensor should be installed with a minimum distance of 0.6 metre to the window to avoid the sensor looking outside. See Figure 2 and 3.

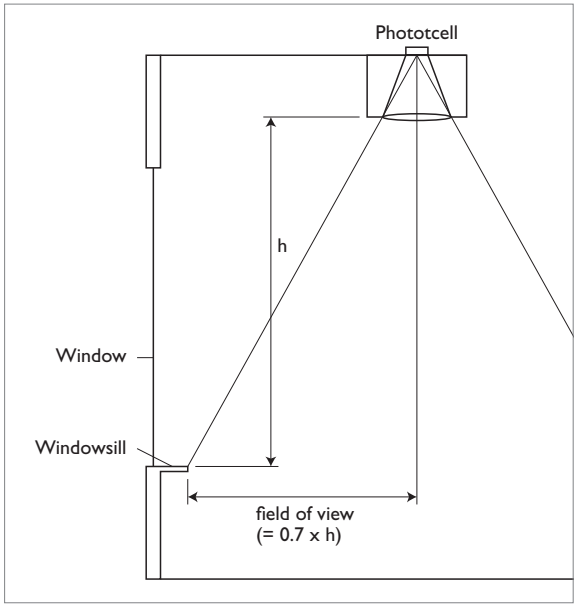


Figure 2

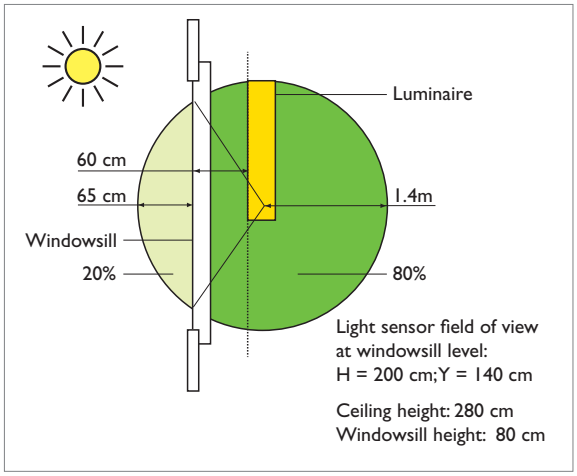
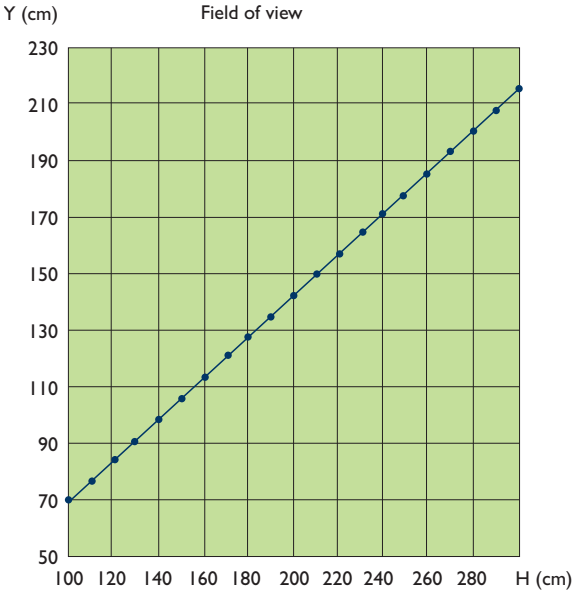


Figure 3

When the sensor is mounted too close to the window it will look partly outside. Sun reflection from a bonnet or a window of a car or snow can reflect directly into the sensor. The sensor will then measure such a high illumination levels that it will steer the artificial light to its minimal level or even switch off the artificial lights.

The optimum distance [Y] from the window to the ActiLume sensor can be obtained from Graph 1. This graph shows the relation between the distance from the window to the sensor [Y] and the height [H] of the sensor.



Graph 1

2.1.5 IR receiver

The infrared receiver serves as a communication portal for the commissioning tool IRT9090/00 and also for the following user interfaces

IRT8010/00
IRT8030/00
IRT8050/00

On request it is possible to supply the Remote Control protocol used for some of the commands for ActiLume enabling OEMs to have personalised remote controls that are able to communicate with ActiLume.

2.1.6 Service button

The service button can be pressed with a pen and is used for changing between Mode 1 and Mode 2 and for calibration. The service button is disabled as soon as one of the Modes 3 till 10 is active. How to use the service button is described in Chapter 5.3.1 Set application Mode via service button (only Mode 1&2) and Chapter 6.4.1 Service button.

2.1.7 Sensor specifications

The ActiLume sensor (LRI1653/01) has an RJ-10 (4p4c) connector fixed to a cable. The length of the cable can either be 100 centimetres or 60 centimetres. Any RJ-10 male-female extension cable can be used to extend the sensor cable up to 5 metres. If this extension wire goes outside the luminaire it should be done according local low voltage installation requirements.

The sensor housing (casing) material is Polycarbonate UL94 V-0 and the colour is dark grey (5 NC 10714 which is close to RAL 7024 "Graphite grey"). The housing is resistant to the glow wire test 850 °C / 5 seconds and has a basic insulation ≥ 1500 V. The dimensions of the sensor are as given below.

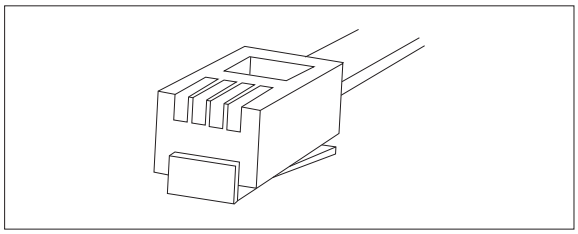


Figure 4

Dimensions in mm	A1	B1	C1
Sensor LRI1653/01	44.7	16.4	15.6

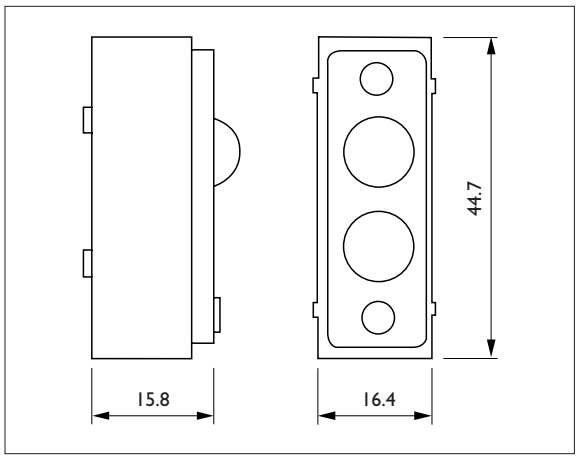


Figure 5

Any further information regarding the build in requirements in luminaires can be found in Chapter 7 Built-in requirements.

2.1.8 Energy savings from daylight sensor and movement detector

Within Western Europe typical savings from daylight harvesting over the whole year can be as shown in Figure 6. A more detailed daylight supply calculation is present within the upcoming norm EN 15193.

	North	South
Winter	Corridor: 20% Window: 35%	Corridor: 25% Window: 45%
Summer	Corridor: 25% Window: 45%	Corridor: 35% Window: 55%

Figure 6

The energy saving potential from presence detection can best be calculated based on the agenda history of a representative population from the related end customer staffing with relation to the preferred Mode.

2.2 ActiLume controller LCC1653/01

2.2.1 LCC1653/01 Controller interaction with daylight supply

In default factory setting the ActiLume controller is supplied with reference values that were stored for a typical office with 3-metre ceiling height, furbished with an office average reflection factor of 0.3 and an installed luminaire configuration that delivers 600 lux on the task area. According to the amount of natural light supplied during the day, the controller compensates and steers either up or down the light levels of the luminaires in order to stay at its set point of 600 lux.

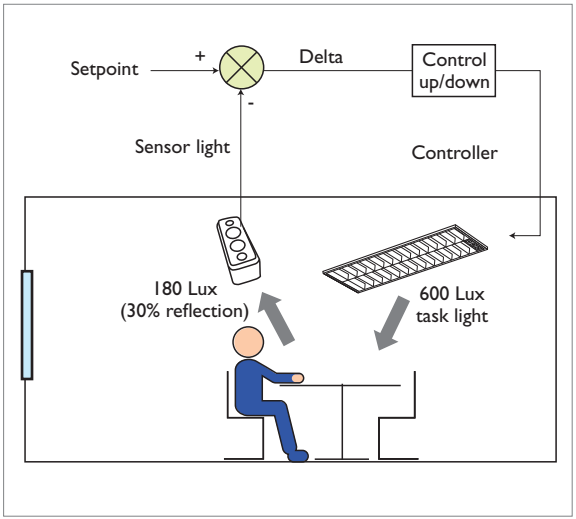


Figure 7

At installation it is advised to calibrate the reference light level according to its own environment with its own reflection factor and its own installed luminaires in order to align with the architects design. The calibration procedure is explained in Chapter 6 Calibration.

2.2.2 Specifications ActiLume controller

Dimensions

Dimensions in mm	A1	B1	C11
Controller LCC1653/01	79.4	30	22.2

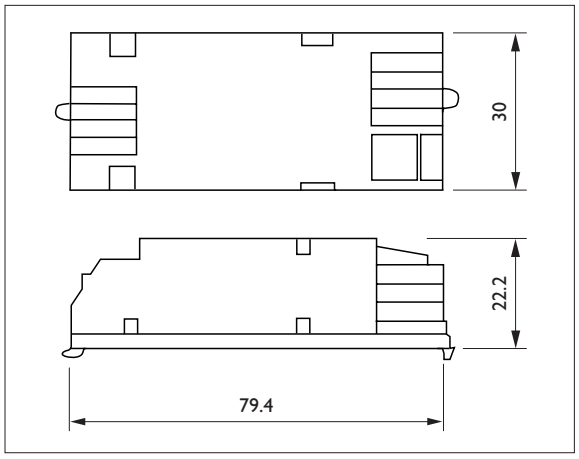


Figure 8

Mains operation	
Rated mains voltage	220 V … 240 V
With tolerances for safety	198 V … 264 V (+/- 10%)
Tolerances for performance	202 V … 254 V (+6%-8%)
Mains frequency	50 … 60 Hz +/- 10%
Input power (system)	0.8 W controller and sensor + 0,05 W per device connected to the system

The standby power consumption of ActiLume is very low. The ActiLume controller has 0.8 W power loss plus 0.05 W per device connected to the system. Additionally there is another 0.35 W standby power loss for each Philips HF-REGULATOR TD EII ballast connected.

Lifetime ActiLume controller

The ActiLume LCC1653/01 controller has a failure rate of 0.2% per 1000 hours measured at a Tcase temperature of 65°C. This equals to 10% failures after 50.000 hours.

At end of life from either the ActiLume controller or the sensor the Philips HF-REGULATOR TD EII ballasts will go to 100% light output as defined by the DALI protocol.

Any further information regarding the build in requirements in luminaires can be found in Chapter 7.3 Mounting.

2.3 LRM8118/00 extension sensor

The ActiLume system also contains a PIR extension sensor (LRM8118/00) in case the area or room is bigger then the 6 x 5 metre coverage of the standard LRI1653/01 sensor (e.g. in a classroom). The PIR extension sensor can be connected to one of the outputs of the ActiLume controller. The power needed by the extension sensor is entirely supplied by the ActiLume controller so no extra mains connection to the extension sensor is required.

Figure 9

More technical details regarding the extension sensor characteristics and installation information can be found in Chapter 7.4.1 Extension sensors (LRM8118/00).

3 ActiLume applications and user Modes

ActiLume has 10 pre-programmed application Modes in which a group of luminaires can be controlled according to Table 1.

Mode	
Mode 1	Cell offices
Mode 2	Open plan offices
Mode 3	Schools / Classrooms
Mode 4	Comfort Mode EN 12464 for open plan (also direct/indirect)
Mode 5	Comfort Mode EN 12464 for cell offices
Mode 6	Corridor
Mode 7	Rest room
Mode 8	Meeting room (with light scenes options)
Mode 9	Open plan offices lights always on
Mode 10	Comfort Mode open EN 12464 plan lights always on

Table 1

This chapter (Chapter 3) explains for which application which Mode suits the best or which lighting design requires which Mode.

3.1 How to design your complete office lighting plan around ActiLume

3.1.1 Modes designed for classic luminaire arrangements

ActiLume has 4 Modes (Mode 1, 2, 3 and 9) that are designed for a classic luminaire arrangement. In these Modes there are luminaires connected to a Corridor (C) group that follow the luminaires of the Window (W) group with + 30% offset.
Both luminaire groups are connected to the master luminaire that contains the ActiLume multi-sensor and controller, which is preferably located at the window side.

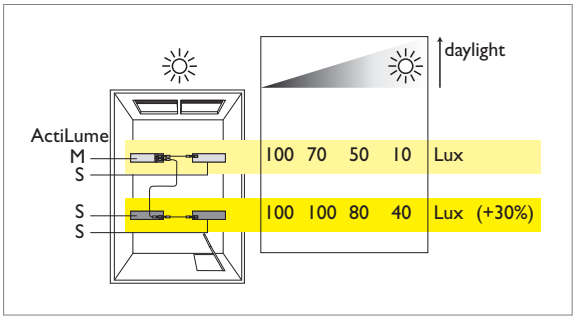


Figure 10

3.1.2 Modes designed for luminaire arrangements according EN 12464

ActiLume has 3 so-called comfort Modes (Mode 4, 5 and 10) that are designed around the new indoor lighting norm EN 12464 (see figure 11). To align the lighting design with the requirements, a different luminaire arrangement approach is an option.
Mode 4, 5 and 10 anticipate on the EN 12464 indoor lighting norm by having the daylight regulation only working for the Task light (choose the Window connection on the controller connector block).

This daylight regulation functions for all other Modes according Chapter 3.2 Day light regulation.

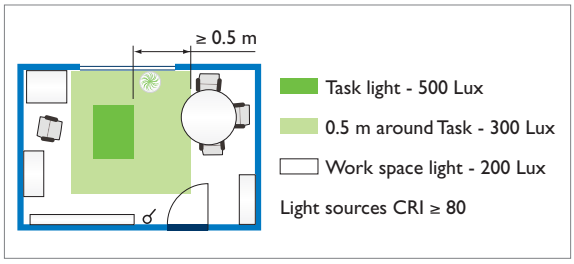


Figure 11

For the Workspace lights (choose Corridor connection on the controller connector block) the daylight regulation is disabled and the lamp power is fixed at 100%.
This allows the use of relative low power compact fluorescent sources for the workspace light for guaranteeing the minimum requirement light level of 200 Lux. This results not only in a more sophisticated lighting design but also into lower power consumption per square metre compared to a classic luminaire arrangement (depending on the design).

Both concepts for comfort and classic luminaire arrangement are displayed below as an example in Figure 12 and Figure 13.

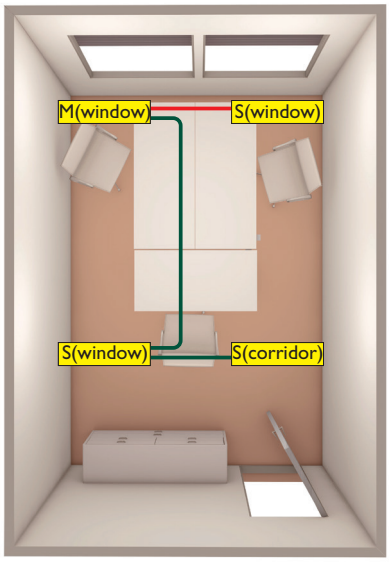


Figure 12
Classic luminaire arrangement
Window light & Corridor light
Corridor light = Window light + 30%
User Mode: 1, 2, 3 or 9

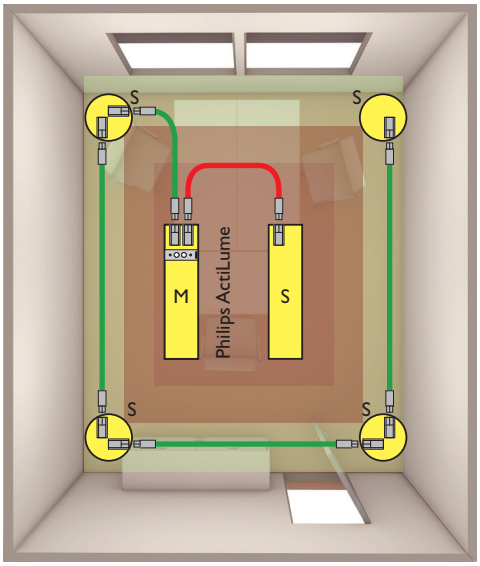


Figure 13
Comfort Mode luminaire arrangement
Task light & Workspace light
Workspace light always at 100% with no day light regulation
User Mode: 4, 5 or 10

3.1.3 Other special Modes

To complete the coverage of all common office applications ActiLume has 3 dedicated Modes designed around a corridor, rest room and meeting room application including scene settings for presentations. How these specific Modes work is explained further on in this chapter. With these 3 dedicated Modes ActiLume covers all common office applications making it possible to offer one single system for a complete building project, and therefore make it easier for the installer, the lighting designer as well as the end user.

3.2 Day light regulation

The light level is measured by the ActiLume multi-sensor LRI1653/01. The daylight supply makes the artificial light dim, until the daylight supply level reaches 1.5 times the calibrated reference level. (The calibrated light level is the light level at 100% lamp power at night). Figure 14 symbols when the level of 1.5 times the reference level is reached, and the lights will be turn off only when there is sufficient daylight for more then 15 minutes. This prevents the lights from continuously going on and off which is also known as oscillation.

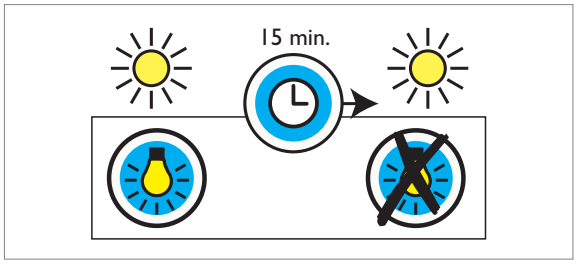


Figure 14

The second figure (Figure 15) on daylight regulation symbols that when someone enters the room while there is sufficient daylight the light stays off. This is a basic ActiLume function, which is applicable to all Modes and referred to as the "daylight over ride".

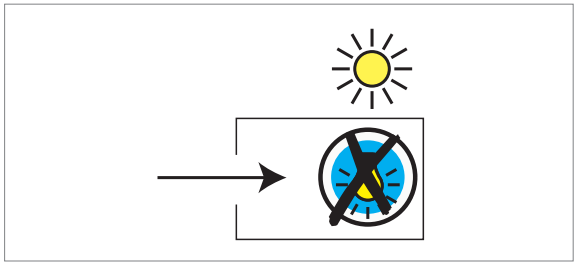


Figure 15

3.3 Movement detection

3.3.1 Delay time

All ActiLume Modes have a standard delay time of 15 minutes before the lights will be turned off or either switched to a lower background light level to save energy. This delay time is applied to all Modes and cannot be altered.

3.3.2 Background level

For all open plan Modes (Mode 2, 4, 9 and 10) the lights will fade down to a background level after reaching the 15 minutes delay time. For Modes 2 and 4 this background light level will be maintained for 120 minutes before the lights will turn off. In Mode 6, for corridors, this is set to 60 minutes and for rest rooms this is set to 15 minutes. By default the background level is set at 20% light output. If needed the background level can be altered to min (1%), 10%, 20%, 30%, 40%, 50%, 60% or 70% of the light level. How to do this is described in Chapter 5.5 Setting the Background level.

3.3.3 Warning period

After the delay time is finished ActiLume starts fading down to min (1%) for those Modes where no background level is defined (classrooms and cell offices). This fading down lasts 17 seconds and is called the warning period. (see also figure 16). After this period the lights are switched off. If within the warning period someone moves because she/he was not detected, the lights go on again and the delay timer is extended to 25 minutes to avoid a second false triggering of the switch off signal. Once the lights are turned off the delay timer is reset to 15 minutes.

If this happens structurally, either furniture can be moved towards the sensor(s) or an LRM8118/00 movement extension sensor can be added to cover the specific detection area. This detection area can be checked by activating the so-called "Walk Test". How to enter this "Walk Test" and how to use it, is described in Chapter 5.10 How to check the coverage of the movement detector.

3.4 Mode 1, Cell office

For cell office applications (as in Figure 17) ActiLume has 3 dedicated Modes. From these Modes, Mode 1 is the basic and most applied Mode. Mode 1 is the default Mode in which ActiLume is supplied. The functioning of Mode 1 is described below in Figure 16.

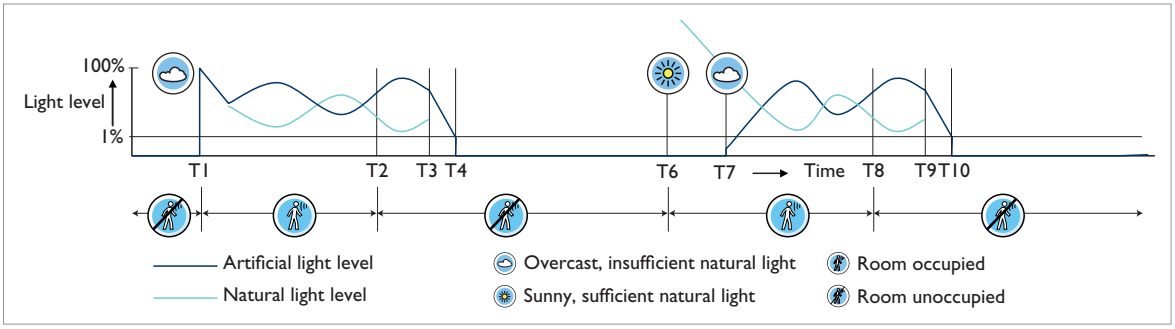


Figure 16

Before T1 no one is in the office, so the lights are off. At T1 some one enters the office, the artificial light will go to 100% and then immediately start to regulate according to the amount of natural daylight. At T2 the person leaves the cell office. The switch off delay time starts. For the warning period see Figure 16 (from T3 to T4). At T6 the person comes back into the office but the lights will stay off because the sun is shining. This is called a day light override. At T7 it becomes cloudy again. The natural light level drops so the artificial light turns on automatically to compensate. At T8 the person is leaving the office. The light level continues to be regulated until 15 minutes later and it starts fading down again.

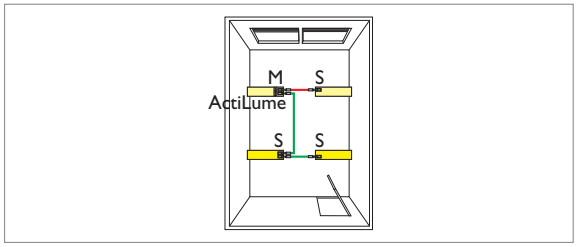


Figure 17

Mode 1 is designed for a classic luminaire arrangement. The master luminaire is implemented at the window side. The luminaire is connected to the window connection of the controller and the others are connected to the corridor side. The corridor side follows the window side with a 30% offset. For cell offices designed around the indoor lighting norm EN 12464, or when using direct/indirect lighting Mode 5 is advised. See Chapter 3.8 Mode 5, Comfort Mode for cell offices.

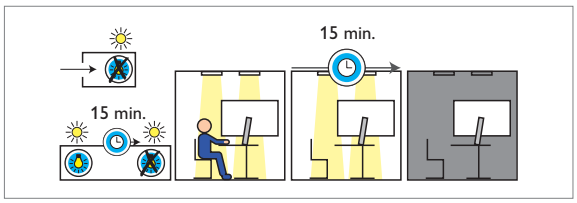


Figure 18

The explanation of the daylight symbols used is described in Chapter 3.2 Day light regulation.

3.5 Mode 2, Open plan offices

Mode 2 functions exactly as Mode 1 but with the difference that in Mode 2 the lights do not turn off after 15 minutes but are set to a background light level. This is to avoid that in parts of an open plan office where no one is present people are not looking into a complete dark area.

Background level

15 minutes after the last movement has been detected,

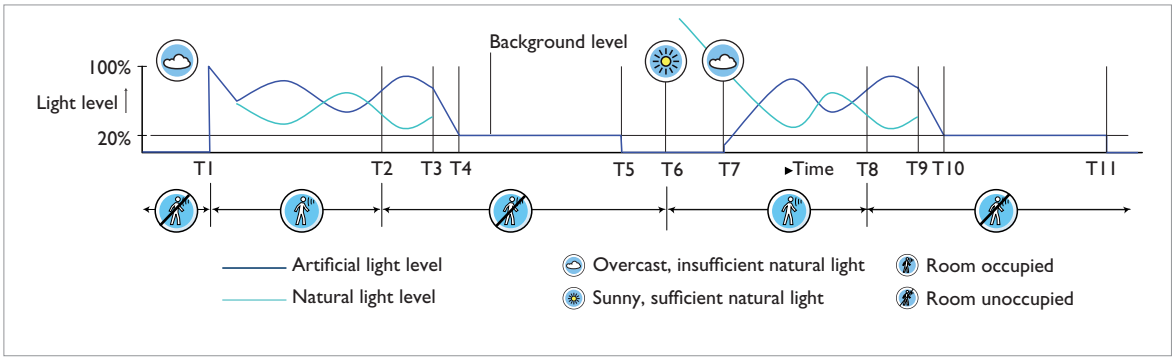


Figure 19

the lights will fade down to 20%. This light level will be maintained for 120 minutes before the lights will be turned off. If needed the background level can be altered to min (1%), 10%, 20%, 30%, 40%, 50%, 60% or 70% of the light level. This is described in Chapter 5.5 Setting the Background level.

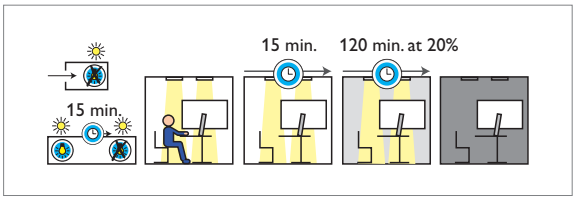


Figure 20

The explanation of the daylight symbols used is described in Chapter 3.2 Day light regulation.

3.6 Mode 3, Schools / Classrooms

Mode 3 is a dedicated Mode for classrooms and school buildings. The Mode functions exactly as Mode 1 though in this Mode the lights must always be switched on manually when entering the classroom. When the last person leaves the classroom the lights will turn off automatically after 15 minutes (like in Mode 1) or can be switched off manually.

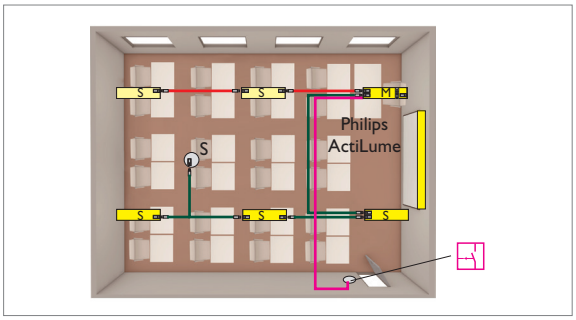


Figure 21

Manual switch on/off
The manual switch on function is to prevent that the lights switch on when people are just passing as many classrooms have windows or opened doors towards the schools corridors. For this application a wall switch, with a push-to-make contact, is advised as being a more solid solution than a remote control.

Extension sensor
Most classrooms exceed the maximum area coverage (5 by 6 metre) of the ActiLume movement sensor. Since the sensor is always close to the window to capture the daylight the classroom entrance is often not reached or covered. Therefore it is advised to use the LRM8118/00 movement extension sensor to assure full coverage (see also Figure 21).

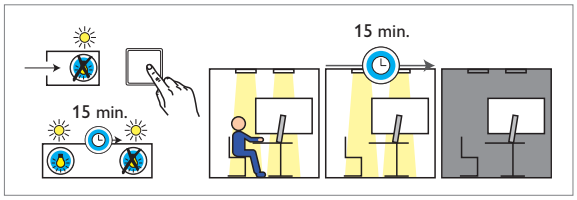


Figure 22

The explanation of the daylight symbols used is described in Chapter 3.2 Day light regulation.

3.7 Mode 4, Comfort & direct/indirect Mode for open plan offices

Mode 4 functions just like Mode 2 except in this Mode the Window and Corridor lights are replaced by Task and Workspace lights. For the workspace light, the daylight regulation is disabled and kept at 100%. This allows the use of low power sources that bring just the required minimum of 200 Lux in the working environment using down lighters or wall washers. This does not only create a different atmosphere but also saves energy versus a classic luminaire arrangement. More about this concept can be found in Chapter 3.1.2 Modes designed for luminaire arrangements according EN 12464.

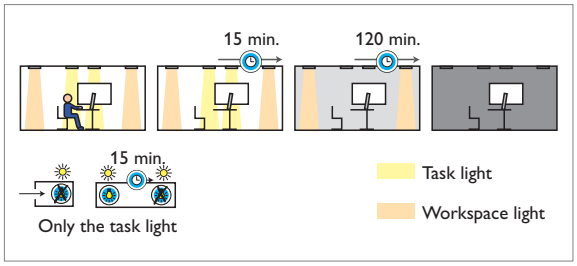


Figure 23

Direct/indirect

To apply direct and indirect lighting the direct lights must be connected to the luminaire containing the Philips ActiLume with a connector labelled "Window". Of course for the direct and indirect lights, separate ballasts have to be used.

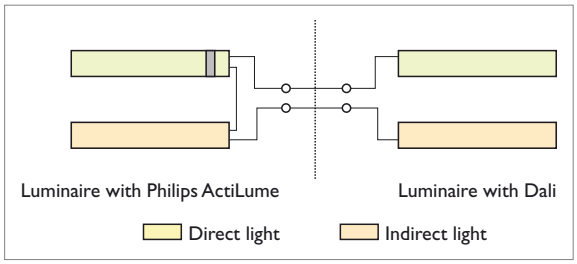


Figure 24

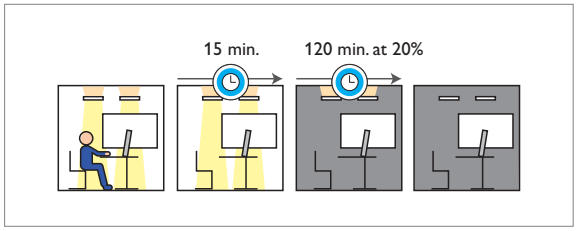


Figure 25

The indirect lights must be connected to the luminaire containing the Philips ActiLume using the connector labelled "Corridor". It must be noted that in this configuration the indirect light is always at 100% lamp power and the direct lighting is functioning according Chapter 3.2 Day light regulation. When from a design point of view the 100% lamp power for indirect is not preferred then Mode 2 can be used as well. Then, the indirect light should be connected to the Corridor. The indirect light then will follow the direct light level with + 30% offset (read: more lightoutput).

3.8 Mode 5, Comfort Mode for cell offices

Mode 5 functions just like Mode 1 except in this Mode the Window and Corridor light are replaced by Task and Workspace light. For the workspace light the daylight regulation is disabled and kept at 100%. This allows the use of low power sources that bring just the required minimum of 200 Lux in the working environment using down lighters or wall washers. This does not only create a different atmosphere but also saves energy versus a classic luminaire arrangement. Moreover, this concept can be found in Chapter 3.1.2 Modes designed for luminaire arrangements according EN 12464.

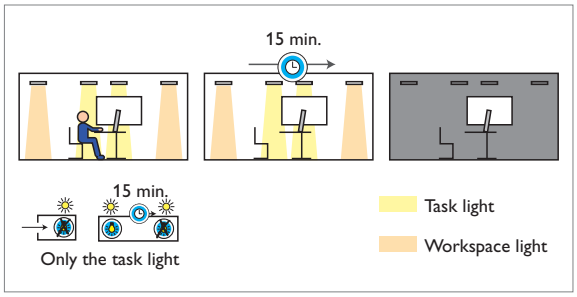


Figure 26

The explanation of the daylight symbols used is described in Chapter 3.2 Day light regulation.

Direct/indirect

To apply direct and indirect lighting the direct lights must be connected to the luminaire containing the Philips ActiLume with a connector labelled "Window"

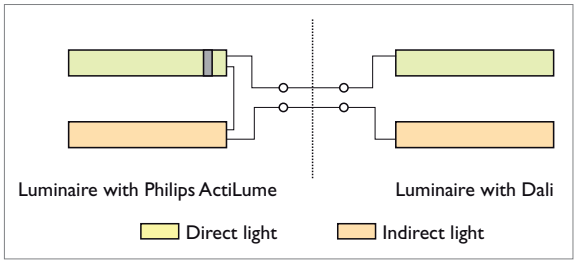


Figure 27

The indirect lights must be connected to the luminaire containing the Philips ActiLume controller using the connector labelled "Corridor" (see Figure 27). It must be noted that in this configuration the indirect light is always at 100% lamp power and the direct lighting is functioning according Chapter 3.2 Day light regulation.

When from a design point of view the 100% lamp power for indirect is not preferred then Mode 2 can be used as well. The indirect light should than be connected to the Corridor.
The indirect light will then follow the direct light level with + 30% offset.

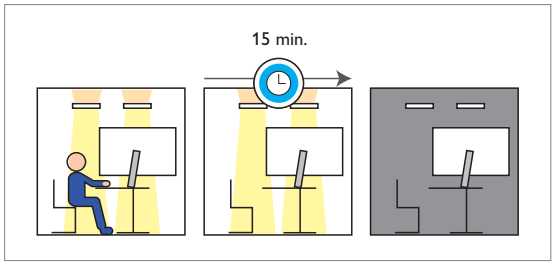


Figure 28

3.9 Mode 6, Corridor

Mode 6 is designed for use in corridors. The daylight switching is disabled. Only presence detection functions according to Figure 29. The delay times cannot be altered. If needed the background level can be altered to min (1%), 10%, 20%, 30%, 40%, 50%, 60% or 70% of the light level as described in Chapter 5.5 Setting the Background level.

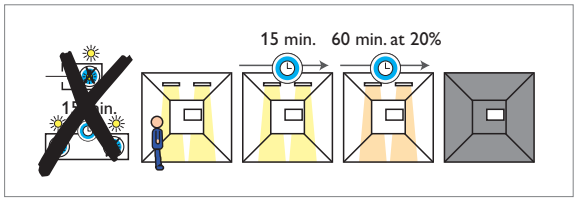


Figure 29

If a corridor is designed with one ActiLume group, additional movement detection coverage is advised as soon as the corridor is longer then 6 metres. With one ActiLume controller and using maximum 2 extension sensors a corridor of up to 18 metres can be configured. However it is more economic to make several small groups as displayed in Figure 30 and maximise energy savings.

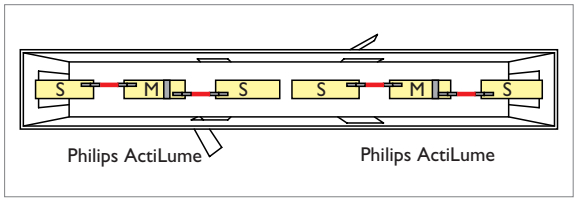


Figure 30

3.10 Mode 7, Restrooms

The restroom application Mode is programmed as follows. When enough daylight enters the restroom, the amount of artificial light will be automatically reduced at the entrance. The amount of artificial light in the cabinets will stay at a predetermined level. If required, it is possible to change these settings at a later stage.

Maximum comfort
The Philips ActiLume system switches the lights automatically on and off on occupancy and regulates the artificial lights down at the entrance when enough daylight is detected. Lights at the entrance will be switched off 15 minutes after the last movement has been detected. The lights in the cabinets will be switched off 15 minutes after the entrance lights have been switched off.

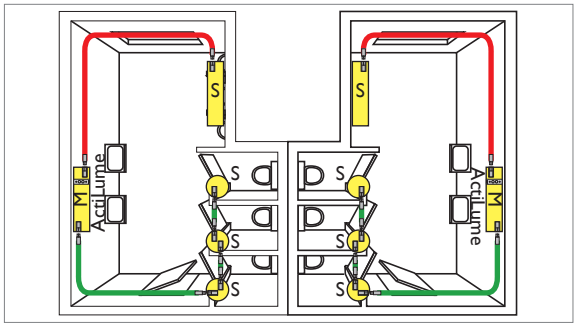


Figure 31

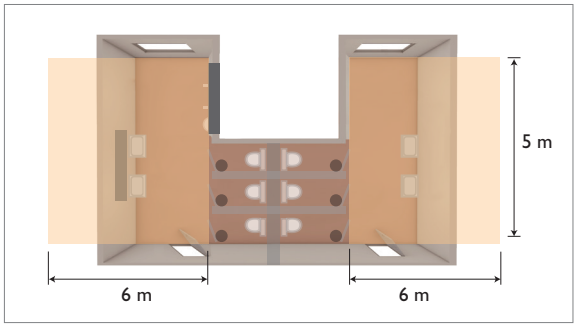


Figure 32

Entrance lights must be connected to the Philips ActiLume luminaire connector labelled "Window" Cabinet lights must be connected to the Philips ActiLume luminaire connector labelled "Corridor" (see also Figure 31).

If in the above configuration the master luminaire is situated more then 3 metres from the cabinets, an extension sensor should be used for full coverage.

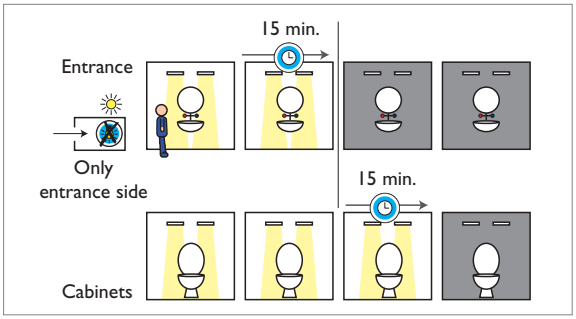


Figure 33

3.11 Mode 8, Meeting room (scene setting options)

In the meeting room application lights will always need to be switched on by means of a push-to-make button or an infrared transmitter. Lights will be switched off automatically 15 minutes after the last movement has been detected. There is no daylight regulation. The Philips ActiLume system allows four different scenes with two groups of luminaires. A scene is a combination of different light levels for each of the two outputs (window and corridor) of the Philips ActiLume system. By using the infrared transmitter IRT8030/00 the combination can be stored in the ActiLume luminaire and selected later on.

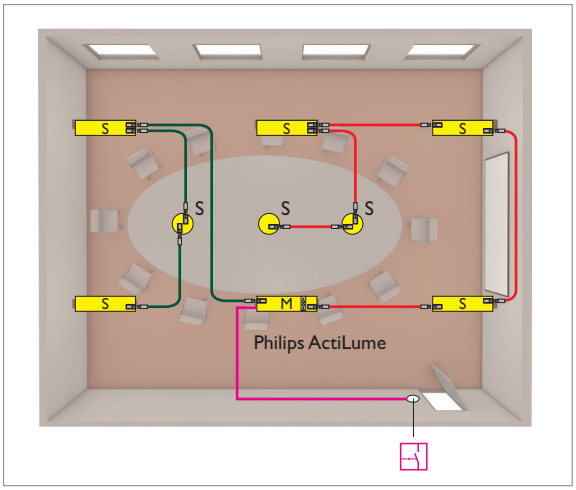


Figure 34

How to use the IRT8030/00 can be found in Chapter 4.2.4 IRT8030/00.

3.12 Mode 9, Open plan offices with lights always on

Mode 9 is a variation on Mode 2 with the exact daylight regulation described in Chapter 3.2 Day light regulation. In Mode 9 the lights do not turn off after 15 minutes but are set to a background light level for an infinite time. This is to avoid that in parts of an open plan office where no one is present people are looking into a complete dark area. This Mode is also useful for areas where due to safety regulations always a minimum light level is required (camera's) or a floor or building switch is used to turn off other electric equipment as well after office hours. To turn off the lights, a building or floor switch is required.

Background level

15 Minutes after the last movement has been detected, the lights will fade down to the background level of 20% (factory setting). The light level can be altered to min (1%) , 10%, 20%, 30%, 40%, 50%, 60% or 70% of the light level as described in Chapter 5.5 Setting the Background level.

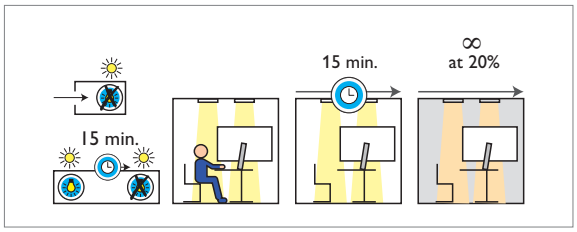


Figure 35

3.13 Mode 10, Comfort open plan EN 12464 lights always on

Mode 10 functions are the same as comfort Mode 4 for open plan offices but in this Mode the background level timer is set to infinity instead of 120 min.

In this Mode the Task light will be connected to Window output of the ActiLume controller and the Workspace light to Corridor output of the ActiLume controller. For the Task light the daylight regulation functions as described in Chapter 3.2 Day light regulation. For the workspace light the daylight regulation is disabled and by default set at 100%. This allows the use of low power sources (down lighters or wall washers) that bring just the EN 12464 required minimum of 200 Lux in the working environment.

This does not only create a different atmosphere but also saves energy versus a classic luminaire arrangement. More about this concept can be found in Chapter 3.1.2 Modes designed for luminaire arrangements according EN 12464. Though the workspace light is by default set at 100% personal light levels still can be made by the use of the infrared transmitte rs IRT8010/00, IRT8050/00 and IRT8030/00.

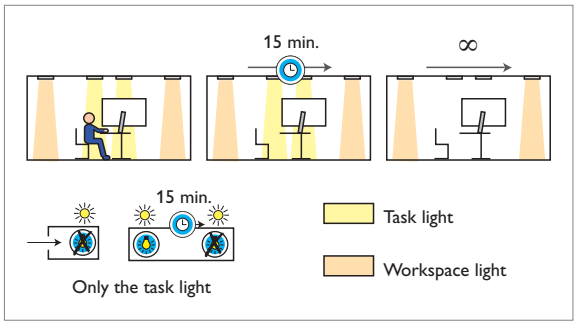


Figure 36

This Mode is useful for areas where from safety regulations always a minimum light level is required (camera's) or a floor or building switch is used to turn off other electric equipment as well after office hours.

3.14 Mode setting overview

MODE	Application	DALI 1/ DALI 2 (minutes)	Delay timer (minutes)	Background timer	Background level (%)	Power-up	Remarks
1	Cell	Auto on/off	15	0	0	off	offset 30%
2	Open plan	Auto on/off	15	120	20	off	offset 30%
3	School	Manual on Auto off	15	0	0	off	offset 30%
4	Open plan	Auto on/off	15	120 (only workspace)	Preset 1 (100%) (only workspace)	off	DLR* only for task light
5	Cell	Auto on/off	15	0	0	off	DLR only for task light
6	Corridor	Auto on/off	15	60	20	on	
7	Restroom	Auto on/off	15	15 (only cubicles)	Preset 1 (100%) (only workspace)	on	DLR* only for wash area
8	Meeting room	Manual on Auto off	15	0	0	off	No DLR*
9	Open plan	Auto on/off	15	infinite	20	on	offset 30%
10	Open plan	Auto on/off	15	infinite (only workspace)	Preset 1 (100%) (only workspace)	on	DLR* only for task light

Table 2

* DLR = Day light Regulation.

4 Manual control

The ActiLume system can work on it's own without the need for any interference of any person. If for whatever reason it is requested to add a personal touch to the light levels it is possible to do so. Within this chapter it will be explained what components are available and their functionality.

4.1 Push button (Touch and Dim) control

ActiLume Touch and Dim will work in combination with any standard mains rated push-to-make switch on the market.

One short touch switches your lights on and off. A firm longer touch will enable you to dim your lights up or down to your personal required level.

4.1.1 Wiring

Push buttons can be connected into parallel, enabling lights to be dimmed from multiple positions in the room, see Figure 37.

Warning
- The system is suitable for 1-phase. The push button shall be connected to the phase, which is also used for the ActiLume controller (L1 in Figure 37).
- For functional reasons it is not recommended to connect one push button to more then one ActiLume controller because ActiLume controllers can react differently.

The wiring diagram as it should be is shown in Figure 37.

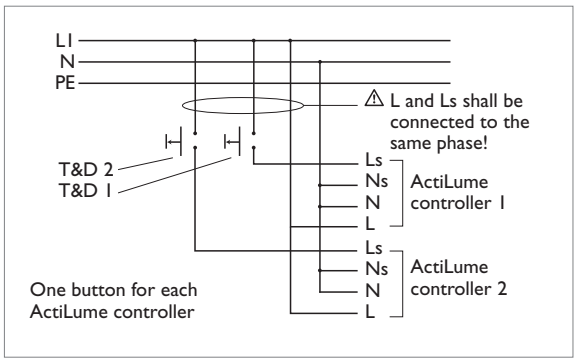


Figure 37

4.2 Infra red (IR) control

The ActiLume sensor has a built-in infrared receiver. This makes it possible to control the ActiLume system by means of an infrared remote control unit without the need to installing extra wiring like for Touch and Dim.

Infrared manual control can be used for following applications:

- Manual switch on which is required for semi-automatic application as Mode 3 and Mode 8.
- Manual override of the automatic control functions.

There are 3 types of remote control units:

Figure 38

IRT8010/00
2-button handheld
1 channel IR control

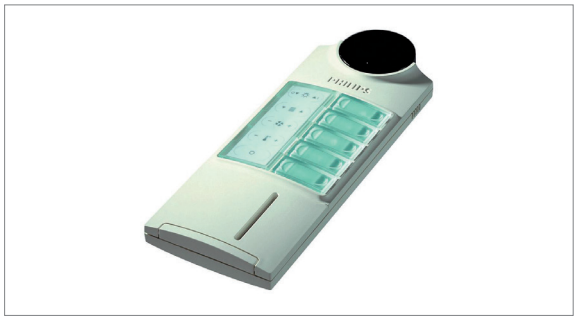


Figure 39

IRT8030/00
handheld or wall mounting
2 channel IR control
4 light presets

Figure 40

IRT8050/00
2-button wall mounting
1 or 2 channel IR control
1 or 2 light presets

Note
Infrared remote control is not useful for application Mode 6 (corridor) and Mode 7 (restroom).

4.2.1 Infrared channels

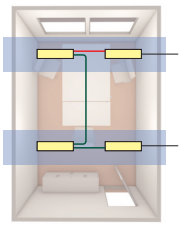
The ActiLume controller has two outputs (Window and Corridor). The way these outputs are assigned to infrared channel 1 and 2 depends on the selected application Mode.

1-channel master/slave light control (used for application Mode 1, 2, 3 and 9):

- The Window connection is assigned to infrared channel 1
- Corridor = Window + 30% (in other words: the Corridor connection will follow the Window connection with a 30% offset)

2-channel task/workspace light control (used for application Modes 4, 5, 6, 7, 8 and 10):

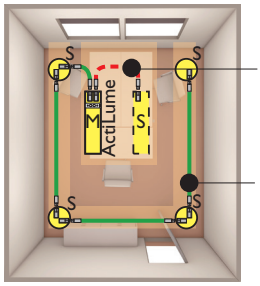
- The Window connection is assigned to infrared channel 1
- The Corridor connection is assigned to infrared channel 2



Application Mode 1, 2, 3 and 9:
Corridor is linked to window (corridor = window +30%)

1-channel control
Infrared channel 1: controls window (corridor follows window)
Infrared channel 2: has no function

Figure 41



Application Mode 4, 5, 6, 7, 8 and 10:
window and corridor can be controlled independently

2 channel control
Infrared channel 1: controls window (task light)
Infrared channel 2: controls corridor (ambient light)

4.2.2 Infrared groups

Individual infrared control in open plan offices is only possible by means of infrared group addressing. Infrared group addressing makes it possible to control your own task light without affecting the light level or status of your neighbours within the same area.

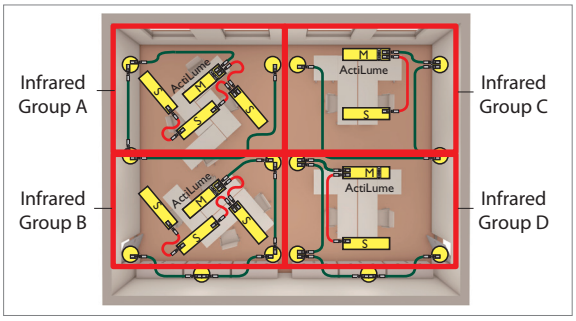


Figure 42

The Infrared group address (group A, B, C, D, E, F or G) of each ActiLume controller can be set by means of the IRT9090/00. For details see Chapter 5.7 Set Infrared group address. The group infrared address of the remote control units IRT8010/00, IRT8030/00 and IRT8050/00 can be set on the remote control unit itself by means of a rotary or dip switches.

Note
The ActiLume controllers and remote control units are by default set into infrared group A (factory setting).

4.2.3 IRT8010/00

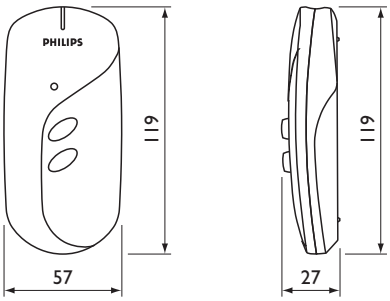


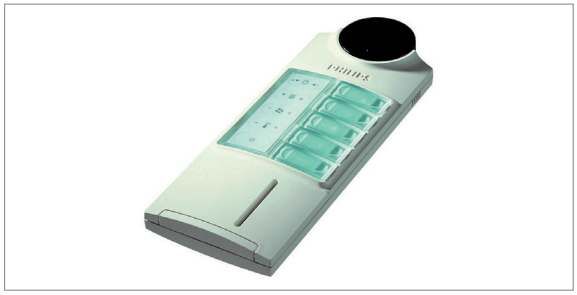
Figure 43 (Dimensions in mm)

- The IRT8010/00 is a two-key handheld transmitter, suitable for the infrared remote control of lighting installations in point-and-shoot applications.
- The IRT8010/00 can be used to switch on and of as well as dim up and down a single lighting control circuits (one channel control).
- The infrared group address can be set by means of a rotary switch within the remote control unit itself.

Recommended Applications

IRT8010/00 is mainly used as hand held transmitter to enable manual override of the ActiLume automatic control system. For 1-channel "semi-automatic" (manual on – automatic off) applications (ActiLume Mode 3) it is recommended to use the IRT8010/00 in combination with IRT8050/00. The IRT8050/00 is than used as a "wall switch", and the IRT8010/00 provides handheld control. Please refer to the IRT8010/00 datasheet for additional information.

4.2.4 IRT8030/00



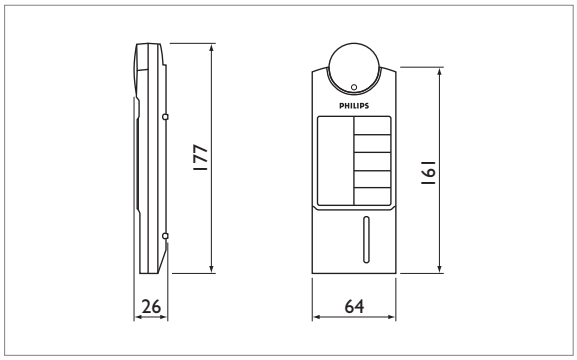


Figure 44 (Dimensions in mm)

- The IRT8030/00 is a 4 preset remote control unit and can be used for wall mounting or tabletop operation (wall holder included).
- The IRT8030/00 can be used to select light presets (scenes) 1, 2, 3 or 4.
- The IRT8030/00 can be used to program light presets 1, 2, 3 and 4 (see note below).
- The infrared group address can be set by means of 3 dipswitches on the unit itself.

Applications

The IRT8030/00 can be used for all ActiLume application Modes. However, the use an of infrared remote control is not useful for application Mode 6 (corridor) and Mode 7 (restroom)

1 channel application Mode 1, 2, 3 and 9 (master/slave operation) WINDOW = infrared channel 1 CORRIDOR = WINDOW + 30%		
Button function	Action	Remarks
Preset 1	WINDOW light level is set to 100% CORRIDOR = WINDOW + 30% Automatic daylight control = enabled	Automatic daylight control will start after switching on the light. CORRIDOR will follow WINDOW with 30% offset.
Preset 2	WINDOW light level is set to 75% (factory value) CORRIDOR = WINDOW + 30% Automatic daylight control = disabled	IRT8030 can be used to change preset value or to recall factory value.
Preset 3	WINDOW light level is set to 50% (factory value) CORRIDOR = WINDOW + 30% Automatic daylight control = disabled	IRT8030 can be used to change preset value or to recall factory value.
Preset 4	WINDOW light level is set to 25% (factory value) CORRIDOR = WINDOW + 30% Automatic daylight control = disabled	IRT8030 can be used to change preset value or to recall factory value.
All off	All lights connected to the ActiLume are turned off. Automatic switch on is disabled	15 minutes after last movement detection, automatic switch on is enabled again (only for full automatic application Modes 1, 2 and 9)

Table 3

Note
Preset 1 will enable automatic daylight control so it is only possible to program preset 1 for infrared channels without daylight control.

2 channel application Modes 4,5, and 10 (task/workspace light) WINDOW = infrared channel 1 CORRIDOR = infrared channel 2		
Button function	**Action**	**Remarks**
Preset 1	WINDOW light level is set to 100% CORRIDOR light level is set to 100% (factory value) Automatic daylight control = enabled for WINDOW	Automatic daylight control will start for WINDOW after switching on the light.
Preset 2	WINDOW light level is set to 75% (factory value) CORRIDOR light level is set to 75% (factory value) Automatic daylight control = disabled	IRT8030 can be used to change preset 2 values or to recall factory value.
Preset 3	WINDOW light level is set to 50% (factory value) CORRIDOR light level is set to 50% (factory value) Automatic daylight control = disabled	IRT8030 can be used to change preset 3 values or to recall factory value.
Preset 4	WINDOW light level is set to 25% (factory value) CORRIDOR light level is set to 25% (factory value) Automatic daylight control = disabled	IRT8030 can be used to change preset 4 values or to recall factory value.
All off	All lights connected to the ActiLume are turned off. Automatic switch on is disabled	15 minutes after last movement detection, automatic switch on is enabled again.

Table 4

2 channel application Mode 8 Meeting room (task/workspace light) WINDOW = infrared channel 1 CORRIDOR = infrared channel 2		
Button function	**Action**	**Remarks**
Preset 1	WINDOW light level is set to 100% (factory value) CORRIDOR light level is set to 100% (factory value) Automatic daylight control = disabled	IRT8030 can be used to change preset 1 values or to recall factory value.
Preset 2	WINDOW light level is set to 75% (factory value) CORRIDOR light level is set to 75% (factory value) Automatic daylight control = disabled	IRT8030 can be used to change preset 2 values or to recall factory value.
Preset 3	WINDOW light level is set to 50% (factory value) CORRIDOR light level is set to 50% (factory value) Automatic daylight control = disabled	IRT8030 can be used to change preset 3 values or to recall factory value.
Preset 4	WINDOW light level is set to 25% (factory value) CORRIDOR light level is set to 25% (factory value) Automatic daylight control = disabled	IRT8030 can be used to change preset 4 values or to recall factory value.
All off	All lights connected to the ActiLume are turned off. Automatic switch on is disabled	15 minutes after last movement detection, automatic switch on is enabled again.

Table 5

Programming presets (light scenes) with the IRT8030/00

Controlling channel 1 and/or 2

First the required channel must be selected, and then the required operation can be executed.

Step 1: select the infrared channel

Channel selection is achieved with the "Select Channel" key. A LED indicates the selected channel. When the "Select Channel" key is momentarily pressed (less than 1/2 second) the LED shows the (last) selected channel. When the key is pressed continuously or repeatedly, the next channel is selected. This action can be continued or repeated until the required channel has been selected. The selection LED stays on for 5 seconds after last key release.

Step 2: off/down – on/up control

With the "Channel On/up" and "Channel Off/down" keys the selected channel can be switched and/or regulated. During the actual transmission of infrared signals, the LED flashes for verification of the selected channel. After transmission the LED is switched off.

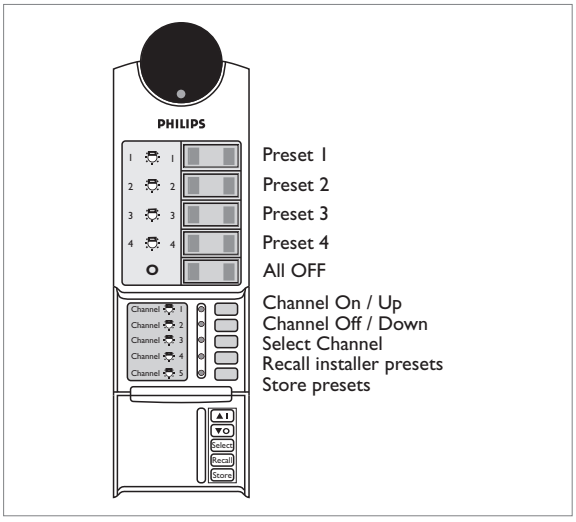


Figure 45

Programming presets

The procedure to be followed is as follows:
Step 1: Adjust individual control circuits as described before
Step 2: Press the "Store presets" key
Step 3: Press the wanted preset key

> **Note**
> Preset 1 can be programmed only for infrared channels that are not using daylight control.

Recall factory presets

At any time the user can revert to the pre-programmed presets as set in the factory, by pressing the "Recall factory presets" key.

Infrared channel 1 is used to control the Windows connection (window light or task light)
Infrared channel 2 is used to control the Corridor connection (workspace light)

The Corridor connection can only be controlled for application Modes 4, 5, 8 and 10

It is not possible to control the Corridor connection for all master/slave application Modes 1, 2, 3 and 9. In these application Modes, the Corridor connection will follow the Window connection with a 30% offset.

4.2.5 IRT8050/00

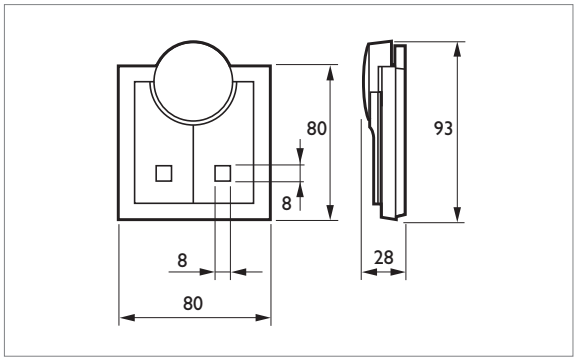


Figure 46 (Dimensions in mm)

- The IRT8050/00 is suitable for wall mounting or tabletop operation. However, the infrared radiation pattern has been optimised for wall-mounted operation.
- The IRT8050/00 can operate in two types of control Modes:
  - Channel control (on/up – off/down)
  - Scene control (also called preset control)
- The control Mode can be set by means of 5 dipswitches on the unit itself.
- The infrared group address can be set by means of another 3 dipswitches on the unit itself.

Applications

Dip switch Button functions								
ID	4	5	6	7	8	Left button	Right button	Remarks
1						Ch 1 off/down	Ch 1 on/up	Only useful for master/slave application Modes 1, 2, 3 and 9 (Corridor is linked to Window).
2		•		•		Ch 1 on/off	Ch 2 on/off	This setting is only useful for all 2-channel application Modes (4, 5, 8 and 10). Left button can be used to switch the task light (Window). Right button can be used to switch the ambient light (Corridor). Dimming is not possible!.
3	•		•			All off	Preset 1	This setting can be used for all application Modes. ActiLume will start automatic daylight control after receiving the preset 1 command.
4	•	•	•	•		All off	Preset 1 ↔ Preset 2	This setting can be used for all application Modes. The right button can be used to toggle between preset 1 and preset 2. Preset 1 will enable automatic daylight control, preset 2 will set the light level to 75% (factory value)
5					•	All off	Preset 1 ↔ Preset 3	This setting can be used for all application Modes. The right button can be used to toggle between preset 1 and preset 3. Preset 1 will enable automatic daylight control, preset 3 will set the light level to 50% (factory value)
6	•				•	All off	Preset 1 ↔ Preset 4	This setting can be used for all application Modes. The right button can be used to toggle between preset 1 and preset 4. Preset 1 will enable automatic daylight control, preset 4 will set the light level to 25% (factory value)

Table 6

5 Commissioning

When installed, the ActiLume system is ready to be used. However for some applications it can be necessary to change the default settings to comply with the needs of the end user or the lighting designer. In that case the ActiLume system needs to be commissioned.

5.1 Commissioning tools

The equipment needed for the commissioning process consists of:

- Service button on the LRI1653/01
- IRT8030/00 (optional)
- IRT9090/00 extended IR programming tool
- Lux measuring equipment (optional)

Tool	Programming function	
Service button	• Set application Mode 1 or 2 • Set reference task light level	
IRT9090/00	• Set application Mode 1…10 • Set reference task light level • Check movement detection coverage area • Set background level • Set power-up state • Set Infrared group address • Request actual application Mode • Recall factory settings	Extended IR programming tool
IRT8030/00	• Program preset 1…4 • Recall factory preset values	Handheld/wall transmitter
Lux measuring equipment	• Check task light during calibration	

Table 7

5.2 Changing the preset values (scene settings)

Presets are used to recall pre-programmed light levels or pre-programmed light scenes. IRT8030/00 shall be used to recall or program presets, see Chapter 4.2.4 IRT8030/00 for detailed information.

5.3 How to set an application Mode

The ActiLume controller has 10 pre-defined application Modes. The default application Mode is Mode 1 (Cell office).

The service button on the sensor can be used to select application Mode 1 or Mode 2.
The IRT9090/00 can be used to select user Mode 1 to 10

Functionality for each application Mode is defined by the value of functional parameters (stored within the ActiLume controller), see Table 8 for the default settings.

Mode	Appli-cation	DALI 1/DALI 2	MD operation	Delay timer (min.)	Background timer (min.)	Background level (%)	Power-up (on-off)	Remarks
1	Cell	Window/corridor (Channel 1)	Auto on/off	15	0	0	off	offset 30%
2	Open plan	Window/corridor (Channel 1)	Auto on/off	15	120	20%	off	offset 30%
3	School	Window/corridor (Channel 1)	Manual on Auto off	15	0	0	off	offset 30%
4	Open plan	Task/workspace (Channel 1/channel 2)	Auto on/off	15	120 (only ambient)	Preset 1 (100%) (only ambient)	off	DLR* only for task light
5	Cell	Task/workspace (Channel 1/channel 2)	Auto on/off	15	0	0	off	DLR* only for task light
6	Corridor	Only Dali 1is used	Auto on/off	15	60	20%	on	
7	Restroom	Wash/cubics (Channel 1/channel 2)	Auto on/off	15	15 (only ambient)	Preset 1 (100%) (only ambient)	on	DLR* only for task light
8	Meeting room	Task/workspace (Channel 1/channel 2)	Manual on Auto off	15	0	0	off	No DLR*
9	Open plan	Window/corridor (Channel 1)	Auto on/off	15	infinite	20%	on	offset 30%
10	Open plan	Task/workspace (Channel 1/channel 2)	Auto on/off	15	infinite (only ambient)	Preset 1 (100%) (only ambient)	on	DLR* only for task light

Table 8

* DLR = Day light Regulation.

5.3.1 Setting an application Mode via service button (only Mode 1&2)

Advantages

- No tool required (only a pen to push the service button).

Disadvantage

- Only possible to select application Mode 1 or Mode 2
- Stepladder required for operating the service button.

Procedure

Service button

The user Mode can be changed between Mode 1 and 2 by means of a short press (<1sec.) on the service button
After the short press, the lamp will flash once or twice indicate the selected user
1 flash = user Mode 1 (cell office)
2 flashes = user Mode 2 (open plan office)

Figure 47

After pressing the service button to select one of the Modes, the artificial lights will flash once if Mode 1 is activated or flash twice if Mode 2 is activated.

Note
The service button Mode select function is disabled if the application Mode is set to Mode 3, 4, 5, 6, 7, 8, 9 or 10 via IRT9090/00.

5.3.2 Setting an application Mode via IRT9090/00

Advantages

- No stepladder required.
- Simple procedure
- Possible to set application Mode 1…10

Procedure

Step 1 Press Mode button

Step 2 Select user Mode 1..10
To select Mode 10 press 1 and 0

Step 3 Press green Send button

Step 4 User Mode request button actual user Mode is indicated by number of light flashes

The IRT9090/00 must be pointed to the ActiLume sensor!

Figure 49

Note
During step 3, the remote control unit must be pointed to the ActiLume sensor., After pressing the green Send button, the electrical light will flash once to confirm the selection.

5.4 Setting the reference task light level

See Chapter 6 Calibration.

5.5 Setting the Background level

For some application Modes, the light level of both outputs is set to a "background" level (20% default value) if there is no movement detection for 15 minutes. The "background" period is defined by the application Mode and can't be changed. The "background" level however can be changed by means of the IRT9090/00.

Mode	Application	Default background level	Background duration
2	Open plan	20%	120 minutes
6	Corridor	20%	60 minutes
9	Open plan 2	0%	Infinite

Table 9

Values: min (1%), 10%, 20%, 30% 40%, 50%, 60% or 70%.

Default value: 20%

Procedure

Step 1 Press background button

Step 2 Select level min (1%), 10%, 20%, 30%, 40%, 50%, 60% or 70%.

Step 3 Press green Send button

IRT9090/00 must be pointed to the ActiLume sensor during pressing the Send button

Figure 50

Note
During step 3, the remote control unit must be pointed to the ActiLume sensor.
After pressing the green Send button, the artificial light will flash once to confirm the selection.

5.6 Setting the Power-up state

The power-up state is the action taken by the ActiLume controller after it is connected to the mains for the first time or if there has been a power failure. The power-up state can be set to OFF or ON by means of the IRT9090/00. If the power-up state is set to OFF then ActiLume starts normal operation 20 seconds (sensor stabilization time) after power-up. That means that ActiLume will keep the luminaires off during the first 20 seconds after power-up. After 20 seconds ActiLume will start normal operation:

- No movement detection: luminaires will stay off.
- Movement detection and insufficient daylight: luminaires will be switch on.

Power-up state OFF will avoid that all the lights in the building will switch on if there is e.g. a mains interrupt during night time.

The default value of the power-up state of the ActiLume controller varies depending on the application Mode as listed in Table 11.

Mode	Application	Power-up state [default value]
1	Cell	Off
2	Open plan	Off
3	School	Off
4	Open plan	Off
5	Cell	Off
6	Corridor	On
7	Rest room	On
8	Meeting room	Off
9	Open plan	On
10	Open plan	On

Table 10

Procedure

Step 1 Press power up button

Step 2 Select Power-Up state

Step 3 Press green Send button

Figure 51

Procedure

Step 1 Press IR group button

Step 2 Select group [A-G]

Step 3 Press green Send button

Figure 52

After setting the Infrared Group Address the relevant remote controls should also be set to the correct Infrared Group Address.

Note
During step 3, the remote control unit must be pointed to the ActiLume sensor.
After pressing the Send button, the artificial light will flash once to confirm the selection

Note
During step 3, the remote control unit must be pointed to the ActiLume sensor.
After pressing the green Send button, the artificial light will flash once to confirm the selection

5.7 Set Infrared group address

The Infrared group address (group A, B, C, D, E, F or G) of each ActiLume controller can be set by means of the IRT9090/00, see Chapter 4.2.2 Infrared groups.
The infrared group address of the remote control unit can be set on the remote control unit itself (rotary or dip switches).

Changing an infrared group address is only useful if infrared is used in open plan offices (personal light control).

Values: A, B, C, D, E, F or G

Default value: A

5.8 Recall default settings (System RESET procedure)

The ActiLume system can be set to default factory settings (out of the box settings) by means of IRT9090/00.

Factory settings are	
Application Mode:	1 (cell office)
Infrared group:	A
Power-up state:	OFF
Background level:	N/A
Set point value:	600 lux at 30% reflection
Infrared Preset values:	P1 = Auto; P2 = 75%; P3 = 50%; P4 = 25%

Table 11

Procedure

Step 1 Press "reset" button

Step 2 Press green Send button

IRT9090/00 must be pointed to the ActiLume sensor during pressing the Send button

Figure 53

Note
During step 2, the remote control unit must be pointed to the ActiLume sensor.
After pressing the green Send button, the artificial light will flash once to confirm the selection.

5.9 Request application Mode

The IRT9090/00 can be used to request the actual application Mode.

After pressing the mode? button, the artificial light starts to flash. The number of light flashes is equal to the actual application Mode, as displayed in Figure 54

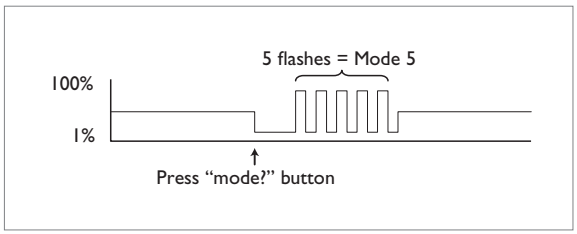


Figure 54

Procedure

Step 1 Press mode? button

IRT9090/00 must be pointed to the ActiLume sensor during pressing the mode? button

Figure 55

5.10 How to check the coverage of the movement detector

The so called "walk test" can be used to check the detection area of the movement detector. The IRT9090/00 can be used to enter the "walk test" by pressing the "test" button.

Behaviour during walk test Mode
If ActiLume detects movement then the artificial light level is set to 100% for 1 second. If no movement is detected then the artificial light level is set to minimal (1%).

This feature makes it possible to check the actual detection area.

ActiLume will stop the "walk test":

- If no movement is detected for 60 seconds
- After pressing the "test" button again.

Note
The IRT9090/00 must be pointed towards the ActiLume sensor during pressing the key.

5.10.1 Using the IRT9090/00

Procedure

Step 1 Press test button to enter "walk test" Mode

Step 2 Press test button again to enter normal application Mode again

IRT9090/00 must be pointed to the ActiLume sensor during pressing the key.

Figure 57

Note
Walk test mode can be used only to check coverage area of the ActiLume sensor. Coverage area of LRM8118/00 extension movement detector has to be checked by means of red walk test LED of the LRM8118/00. Instead of setting the artificial light to 100% for 1 second, the red LED inside the LRM8118/00 will be switched on for 1 second.

6 Calibration

After installation there is a possibility that the reference task light level is not according to the end user needs (too low or too high light level). In that case the system has to be calibrated (set reference task light level to correct value). This section describes several methods to calibrate the system. For simplicity reasons it is recommended to use the IRT9090/00 for system calibration.

6.1 Introduction

The ActiLume light sensor is measuring the reflected task light. The reflection factor highly depends on the furnishing (dark or light, glossy or frost surface) and can vary between 10...50% (0.1 ... 0.5).

ActiLume is using a so called "closed loop" control system. The output of the ActiLume light sensor (sensor light) is proportional to the reflected task light level.

The ActiLume controller compares the "sensor light" (the reflected light) with an internal "set point". The artificial light is controlled in such a way that the difference between "set point" and the "sensor light" signal is as small as possible, see Figure 58 below.

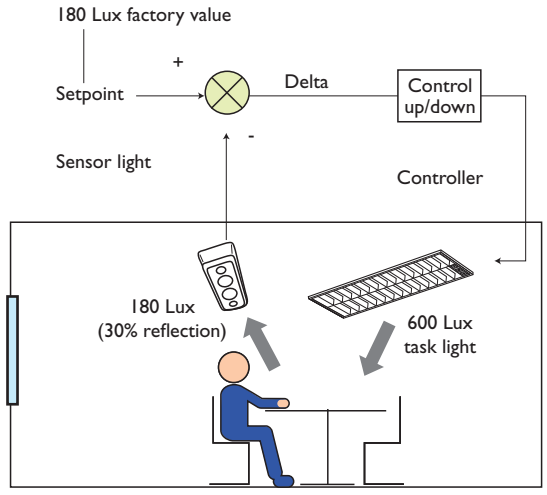


Figure 58

Example
If the sensor light is increasing due to the increasing natural light then the error signal
(Error = set point - sensor light) will dim the artificial light until the value of the error signal is equal to 0.
That means that decreasing artificial light compensates increasing natural light. This will result in a more or less constant task light level.

If the sensor light is decreasing due to decreasing natural light then the error signal (Error = set point - sensor light) will raise the artificial light until the value of the error signal is again equal to 0.
That means that increasing artificial light is compensating the decreasing of the natural light. This will result again in a more or less constant task light level.

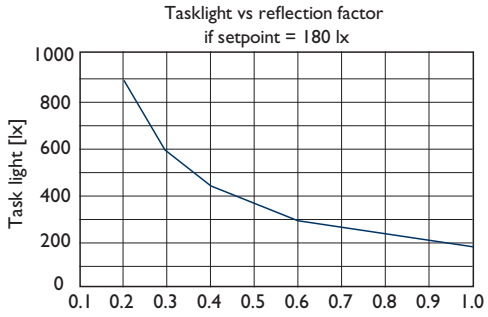
Changing the set point value can change the reference task light level.
Increasing set point value will result in increasing reference task light level. Decreasing set point value will result in decreasing reference task light level.

6.2 Task light level after installation

The task light level is defined by set point value and reflection factor:

$$\text{Task light} = \frac{\text{Set point}}{\text{Reflection}}$$

The reflection factor (0.1….0.5) is defined by the furnishing and can't be changed. Task light as function of reflection factor is shown in Graph 2 below.



Graph 2

Reflection factors < 30% (dark furnishing) will result in a task light level > 600 lux.
Reflection factors >30 % (light furnishing) will result in a task light level < 600 lux.

Calibration
If the (reference) task light level is too low or too high then it is possible to set the task light level to the correct value by changing the set point value of the ActiLume system.

Increasing the set point level will result in a higher task light level.
Decreasing the set point level will result in a lower task light level.

6.3 When to calibrate the ActiLume system

- After the furniture is in place, fine-tuning can be done later.
- Re-calibrate after changes have been made in the room. The ActiLume system must be recalibrated when room paint, carpet, wall art or furniture is modified.

The ActiLume system shall be calibrated without natural light (close window blinds or at night).

In most of the applications, the ActiLume system will operate satisfactory without the need to calibrate the system because the factory settings are designed for an average office. However it is required to calibrate the lighting system if the artificial light level is too low or too high.

6.4 Calibration methods

There are several methods to set the reference task light level to the required level:

- Calibration via service button (located on ActiLume sensor)
- Via Touch and Dim or infrared remote control unit in combination with service button.
- Via infrared remote control IRT9090/00

6.4.1 Service button

Advantages
- No calibration tool required (only a pen to push the service button).

> **Note**
> - Not possible to set reference task light level to personal preference.
> - In most cases a stepladder is needed to operate the service button.

Procedure

Press the service button until the lamp gives a light flash (wink).
The light output of the luminaires connected to (Task) is set to 80%. The light output of the luminaires connected to Corridor (Ambient) is to 100%. Wait 30 seconds, then the ActiLume controller is saving the actual light level as new reference light level (indicated by a second light flash). This 30 seconds time delay is required to have sufficient time to step aside or to remove the step ladder.

Figure 59

> **Note**
> 80% light level is used to compensate lumen depreciation over lifetime of the lamps. Lighting systems are "over" designed because lighting levels gradually drop as the system ages due to dust, luminaire reflector efficiency depreciation and lamp lumen depreciation. By setting the initial light level to 80%, additional energy savings are achieved.

6.4.2 Extended IR programming tool IRT9090/00

Advantages

- **Reference task light level can be set to personal preference.**
- **No stepladder required.**
- **Easy to use**

Procedure for IRT9090/00

Step 1 Set the light level to the desired value, using the arrow up or down button

Step 2 Wait 2 seconds and than press the SAVE button

IRT9090/00 must be pointed to the ActiLume sensor!

Figure 61

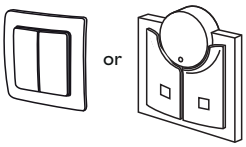
After pressing the SAVE button, the artificial light will flash once to confirm the selection.

6.4.3 Infrared or push button (Touch and Dim) control

Advantages

- **Reference task light level can be set to personal preference**
- **Useful when no IRT9090/00 is available.**

Step 1: Adjust the light level with a Touch and Dim button.



Step 2: Step on the ladder at the master luminaire and press service button (<1 sec.) within 30 seconds after step 1.

Note: After manual dimming the mode select (service button) is disabled for 30 seconds.

Figure 62

> **Note**
> - Push button or infrared remote control unit required
> - Stepladder required for operating the service button.
> - Service button must be pressed within 30 seconds after last dim command.
> - Does not function in combination with Mode 3 to 10.

7 Built-in requirements

Within this chapter it will be explained how the various components can mount into a luminaire and what issues to take into consideration. This to achieve the most optimum performance of the ActiLume system.

The ActiLume is a luminaire-based light control system. The ActiLume system consists of 2 elements:

- ActiLume sensor LRI1653/01
- ActiLume Controller LCC1653/01

7.1 Wiring inside the luminaire

For connecting the Window and Corridor (respectively DALI 1 and DALI 2) line(s) from the controller to the DALI inputs of the various DALI ballasts, standard mains rated wiring should be used. The controller (LCC1653/01) is equipped with WAGO 251 universal connectors for the mains connections, switched mains connection and Window and Corridor connections. This connector is suitable for both automatic wiring (IDC and ADS) and manual wiring (see Figure 67). The wire diameter used should however be from 0.5 mm^2 to 1.0 mm^2 or from AWG 24 to AWG 18.

The sensor will be connected to the controller by means of a RJ-10 4p4c connector that is already connected to the sensor by the factory.

See also Figure 69 for an internal wiring diagram.
Internal wiring should always comply with IEC 60598-1.

7.2 Wiring outside the luminaire

Furthermore, the length of the cable between the ActiLume controller and the various ballasts (so to the different luminaires) is restricted in length. The maximum total allowed length of the control cables is 30 metres (Window + Corridor). The lead diameter is minimal 0.5 mm^2 (AWG 24) but advised is to use at least 0.75 mm^2 (AWG 21).

Also outside the luminaire, for connecting the Window and Corridor (respectively DALI 1 and DALI 2) line(s) from the controller to the DALI inputs of the various DALI ballasts, standard mains rated wiring should be used. This length limitation and minimum lead diameters are there to ensure that the communication between the controller and the various ballasts is flawless and EMI (Electro Magnetic Interference) limits are not crossed.

7.3 Mounting

7.3.1 Sensor (LRI1653/01)

The standard sensor LRI1653/01 (Figure 63) of the ActiLume system can be mounted in various different ways. There are a few options given by means of some ridges on either long sides or by means of 2 latching rills at the back of the sensor (Figure 64).

Figure 63

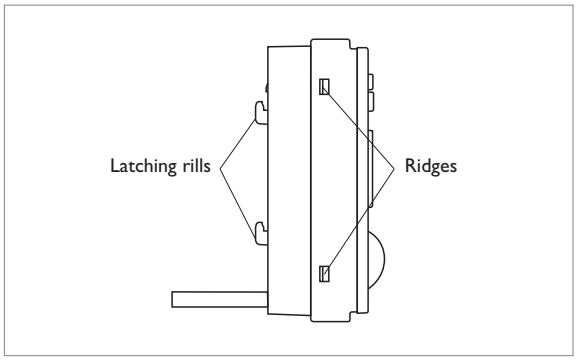


Figure 64

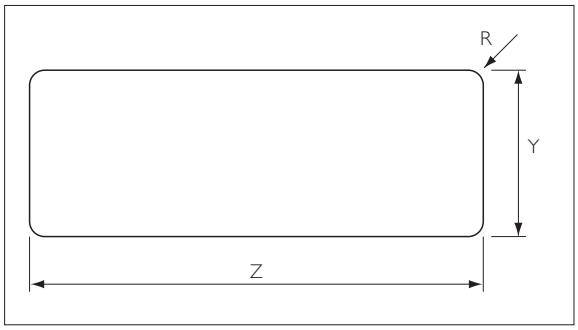
Connection of the sensor to the controller will be done by means of a RJ-10 4p4c connector that is fixed to LRI1653/01 cable.

To minimize EMI, it is also required to install the sensor at the cold-wired lamp side (lamp side with the longest wiring according to the ballast wiring diagram) if the sensor is mounted close to the lamp. It is not recommended to install the sensor wiring close to and in parallel with the lamp or lamp wiring. This to reduce EMI.

The temperature anywhere on the housing of the sensor should stay between 0°C and +55°C. Going outside this range, will have effect on the performance as well as on the lifetime of the LRI1653/01.

The sensor can also be mounted into a rectangular punch hole. To do this, the hole should have the following dimensions:

	LRI1653	LRI1653 + LCA8000
R	2.0	2.3
Y	13.9	17
Z	40.9	44



Note
The heat dissipation of the sensor circuit itself is negligible. For that reason no maximum temperature point (Tc point) is specified on the sensor housing.

7.3.2 Sensor cable

The sensor cable should be routed within the luminaire in such a way that there is no chance that it will become damaged (e.g. cutting on sharp edges of the metal parts). If damage is likely to occur, additional mechanical protection is necessary (e.g. an extra sleeve around the sensor cable).

Wrong connection of the sensor to the ActiLume controller is not possible due to the modular connector system.

The cable that connects the sensor LRI1653/01 to the controller (LCC1653/01) can withstand a maximum temperature of 60 °C. If higher temperatures are applied to the cable, it will deteriorate the cable, which can lead to permanent damage or even break down of the cable.

The sensor is standard fitted with a 100 cm or a 60 cm cord. If required the length of the cord can be extended by means of a standard male / female RJ-10 extension cord. An extension cable up to 5 metres can be used but it should be installed according to local low voltage installation requirements when going outside the luminaire.

7.3.3 Sensor position

It is required to install the sensor at cold-wired lamp side to minimize EMI. The side of the lamp that is connected to the ballast with long wires is defined as "cold-wired" lamp side.

7.3.4 Controller (LCC1653/01)

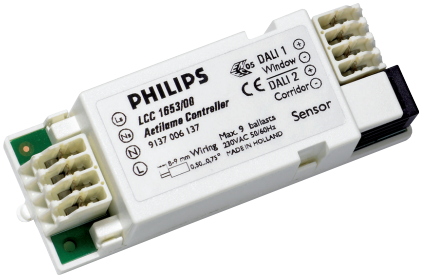


Figure 65

The controller LCC1653/01 (Figure 65), which is the heart of the system, can be fixed into a luminaire by means of ridges at the two far ends of the housing. There is no specific location where the controller has to be positioned. To be able to fix the controller into the luminaire, only two holes are needed that have the below mentioned dimensions and distance (Figure 66).

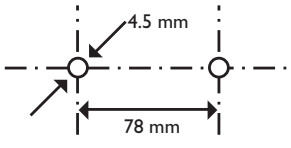


Figure 66

7.3.5 Wiring to and from the ActiLume controller

The sensor and controller can be connected together by means of a RJ-10 4p4c connection of which the male connector is clinched to the wire end of the sensor and the female connector is mounted on the controller.

For connecting all other wires to the controller (mains, switched mains and the DALI outputs) wiring is greatly simplified by the usage of WAGO 251 universal connectors. This type of connector is suitable for both automatic wiring (IDC and ADS) and manual wiring (Figure 67).

All wiring connected to the controller should be mains rated wiring. See also Chapter 7.1 Wiring inside the luminaire and 7.2 Wiring outside the luminaire.

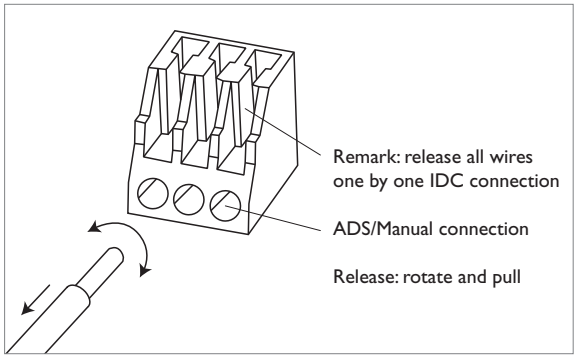


Figure 67

Wire options and specifications

ADS manual connection	0.5 mm - 1.0 mm	2 (AWG 22 to 18)
IDC connection	0.5 mm - 0.75 mm (Also stranded)	2 (AWG 22 to 20)
Wire strip length	8.0 mm - 9.0 mm	

When all components are mounted into the luminaire the complete wiring diagram should look like Figure 70:

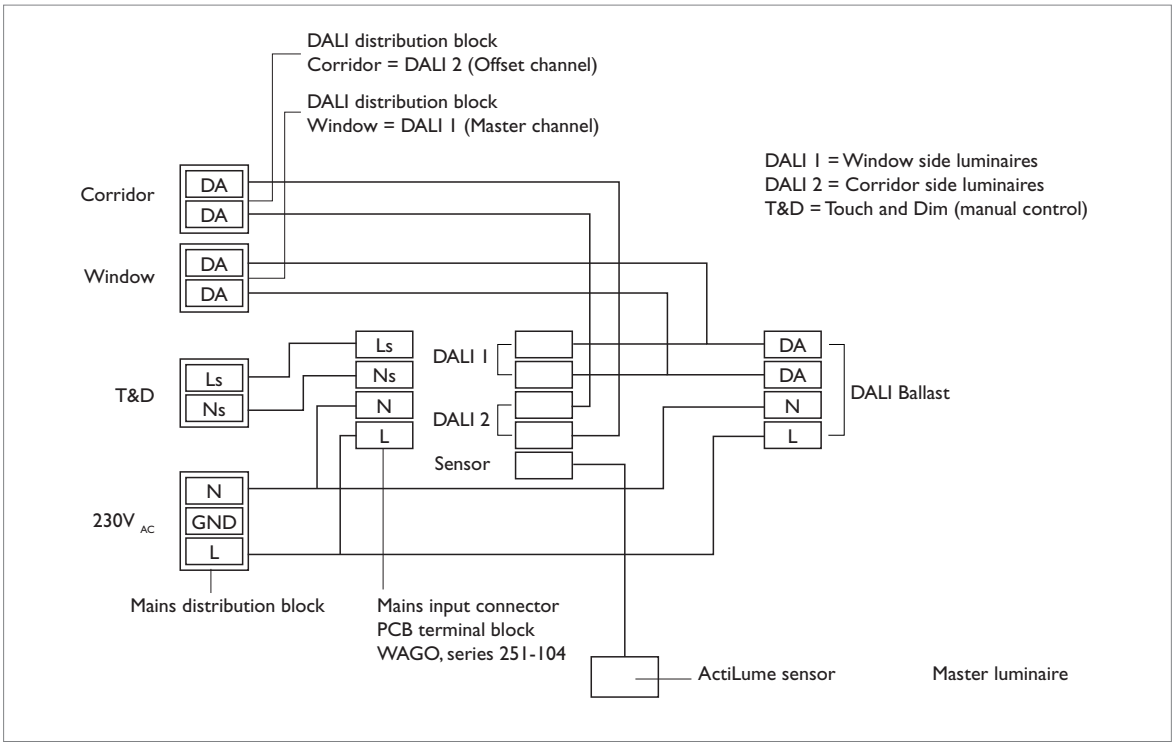


Figure 68

7.4 Installation/system configuration

An ActiLume system consists of an ActiLume controller, an ActiLume sensor, one or more ballasts and possibly one or two extension sensors if needed. In Chapter 7.4.3 System capabilities and limitations there is a table (Table 11) that gives you the number of ballasts and extension sensors that can be used within one system. How or where you connect the ballasts and extension sensors to (Window side or Corridor side connection) is not fixed. You can connect an extension sensor to the Window connection as well as the Corridor connection. You are also allowed to connect e.g. 5 ballasts to the Window connection and none to the Corridor connection or visa versa. The system is completely flexible with respect to this issue. Furthermore, the ActiLume system works as a stand-alone system. This means that it is not possible to connect multiple ActiLume controllers with one another or connect an ActiLume system to any type of bus system.

7.4.1 Extension sensor (LRM8118/00)

Figure 69

In case the standard sensor (LRI1653/01) has insufficient coverage of movement (e.g. in a classroom. See Figure 70), using an extension sensor, the LRM8118/00 (Figure 69), can increase the movement detection area. Both, the ActiLume sensor LRI1653/01 as well as the extension sensor LRM8118/00, have a predefined detection area of 5 x 6 metre at a ceiling height of 2.5 metres. More detailed information on the movement detection coverage can be found in Chapter 2.1.1 Movement detector. The extension sensor can be connected to any of the outputs of the controller (Window or Corridor). The connection to the Window or Corridor line is established by means of a 2-pole screw / clamp connector (Figure 71).

The tie-wrap near the clamp is to be used as a strain relief for the cable (Figure 72).

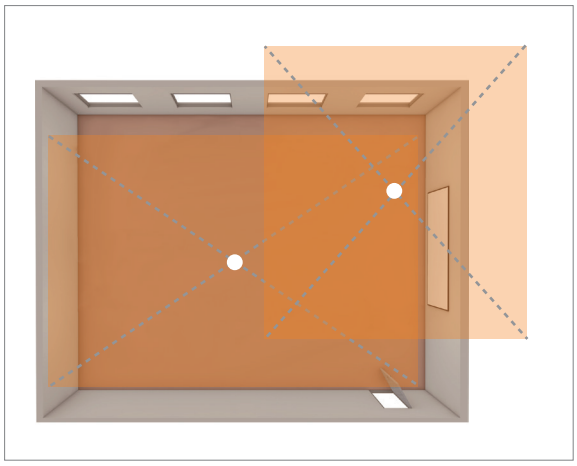


Figure 70

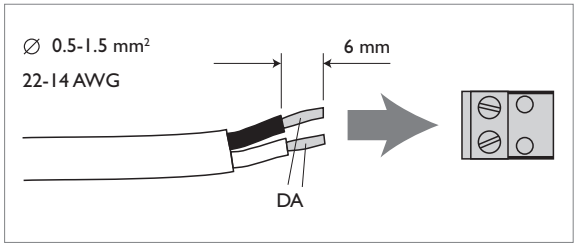


Figure 71

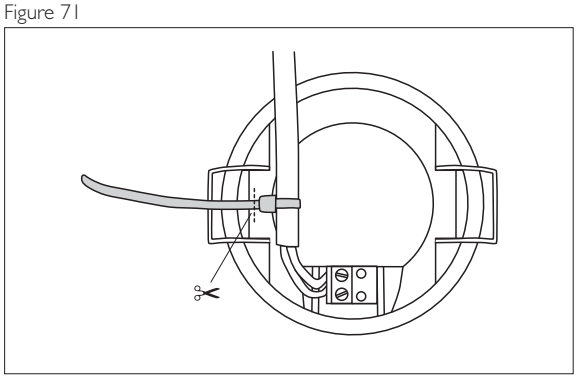


Figure 72

After connecting the wire to the 2-pole screw/clamp connector the extension sensor can be mounted into the ceiling. A connection to the mains is not needed since the extension sensor will get its power from the ActiLume controller. The extension sensor can be mounted into a hole with a diameter of 64 mm (Figure 73). The position in the room should be chosen in such a way that all sensors together cover the biggest possible area. After connecting the extension sensor to either the Window or Corridor connection, it will work in conjunction with the ActiLume system without any need for commissioning.

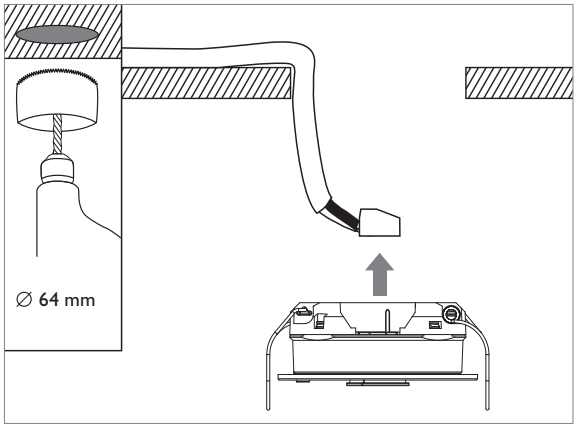


Figure 73

Some more dimensional issues that have to be taken into account when using an extension sensor can be found in the drawing below (Figure 74).

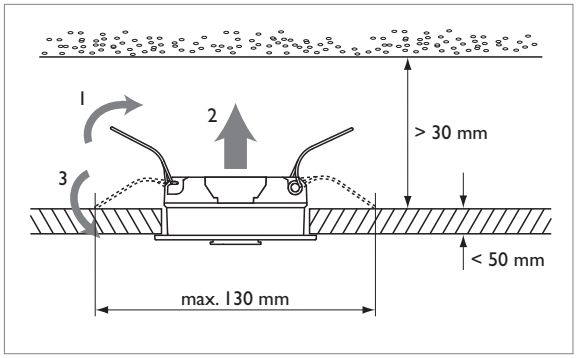


Figure 74

The extension sensor can also be installed much later, if it is discovered that the coverage of the ActiLume sensor (LRI1653/01) is insufficient. Hence: Care has to be taken that the limits given in Table 12 in Chapter 7.4.3 System capabilities and limitations are not crossed. The extension sensor can be connected anywhere along the Window or Corridor connection. Whichever of these 2 connections is used will give the same functional end result.

7.4.2 Extension sensor (LRM8118/00) view shield

If the detection of movement by the LRM8118/00 in a certain area is not wanted, it is possible to pull out a view shield from the extension sensor. This view shield can than be rotated so the correct area is shielded off from the detection area. See also Figure 75.

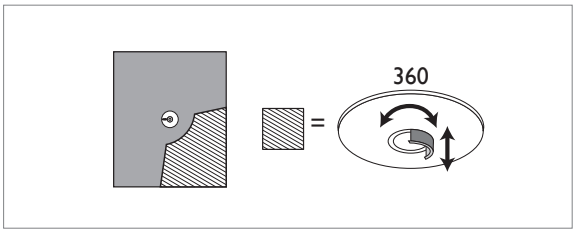


Figure 75

7.4.3 System capabilities and limitations

The number of ballasts that can be connected to the ActiLume controller is limited and also depends on how many extension sensors are to be used as well. In the following table (Table 12) you will find how many ballasts in combination with extension sensors can be used at maximum on 1 ActiLume controller.

# of ballasts	# of extension sensors (LRM8118/00)
1	2
2	2
3	2
4	2
5	2
6	2
7	2
8	2
9	2
10	1
11	0

Table 12

Q 1 Is it allowed to connect one push button to more then one ActiLume controller?

No. One button for each ActiLume controller, see Figure 76.

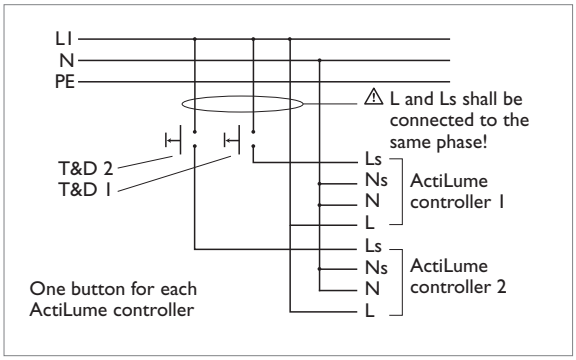


Figure 76

Q 2 Is it allowed to connect the push button and ActiLume controller to different phases?

No. The L and Ls input must be connected to the same phase (L1, L2 or L3), see Figure 76.

Q 3. What happens with the automatic switch on function after switching off the light via the push button?

The light will stay off as long as the room is occupied. The automatic switch on function (if supported by the actual Mode of operation) is enabled again if the room is unoccupied for at least 15 minutes.

Q 4. Is daylight control function still active after changing the light level via the push button or remote control?

Yes. Some seconds after changing the light level, ActiLume is using the new task light level as new reference level (temporary set point) for the daylight control function. Every time the light is switched on manually or automatically, ActiLume is using the calibrated reference level (default set point) again.

Q 5. At what light level is the light switching on when I use the push button or remote control?

Case 1

Daylight control enabled (all application Modes except Mode 8):
The light will switch on at 100% light level, also if there is sufficient daylight. After switching on the light, ActiLume starts automatic daylight control. The artificial light level will dim down until the task light level is equal to calibrated reference level (default set point).

Case 2

Daylight control disabled (application Mode 8):
The light will switch on at the last used light level.

Q 6. Should I connect the push button also to the T&D input of the ballasts?

No. That is not possible because the T&D inputs of the connected ballasts are to be used for communication between the Actilume controller and the ballasts. All connected ballasts are controlled by a push button via the ActiLume controller.

Q 7. What happens with the automatic switch on function after switching off the light via infrared?

The light will stay off as long as the room is occupied. The automatic switch on function (if supported by the actual Mode of operation) is enabled again if the room is unoccupied for at least 15 minutes.

Q 8. Is it possible to disable automatic daylight control?

Yes. Preset 2, 3 or 4 commands will disable automatic daylight control. In Mode 8 automatic daylight control is also disabled.

Q 9. Is it possible to change preset values?

Yes. See Chapter 4.2.4 IRT8030/00

Q 10. Is it possible to use infrared control in open plan applications with multiple ActiLume systems?

Yes. Infrared group addressing makes it possible to control the light for each group individually, see Chapter 4.2.2 Infrared groups.

Q 11. Is it possible to control multiple ActiLume groups with one infrared remote control unit?

Yes. The infrared group address of the remote control unit can be set to “all groups”. This feature makes it possible to control all infrared groups with only one remote control unit.

Q 12. Is it possible to disable the PIR sensor?

No. It is not possible to disable the PIR sensor. There is no Mode available in which the PIR sensor is switched off.

9 Software settings summary

		Cell office (master/slave)	Open plan (master/slave)	School (master/slave) semi automatic	Open plan: task / workspace light	Cell office: Task / workspace light	Corridor	Toilets (EEPROM data)	Meeting rooms (scene settings)	Open plan: master/slave mains switching	Open plan: task / workspace mains swiching
Special Function Register	**Range**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Power-up state	lichts OFF										
	lichts ON										
Background level	min (1%) (or special background)	No		No	PI	PI		PI	No		PI
	10%										
	20%										
	30%										
	40%										
	50%										
	60%										
	70%										
Special Function Register	**Range**										
Occupancy mode	manual on - auto off										
	auto on - auto off										
	conditional										
Movement detection	disable										
	enable										
Controlled luminance	disable										
	enable										
Block auto-on if sufficient daylight	disable										
	only window/task										
	window/task + corridor/workspace										
Switch light off if sufficent daylight	disable										
	only window/task										
	window/task + corridor/workspace										
Timer Control Register	**Range**										
Delay timer	1 min										
	5 min										
	10 min										
	15 min										
	20 min										
	25 min										
	30 min										
	35 min										
Extension timer	0 min										
	5 min										
	10 min										
	15 min										

		Cell office (master/slave)	Open plan (master/slave)	School (master/slave) semi automatic	Open plan: task / workspace light	Cell office: Task / workspace light	Corridor	Toilets (EEPROM data)	Meeting rooms (scene settings)	Open plan: master/slave mains switching	Open plan: task / workspace mains swiching
Special Function Register	**Range**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Background timer	0 min										
	15 min										
	30 min										
	60 min										
	90 min										
	120 min										
	150 min										
	infinite										
Manual Control Register	**Range**										
Manual control mode	Master/slave 1 channel control										
	Master/slave 2 channel control										
	2 channel standard (scenes)										
	2 channel (task + workspace light)										
IR channel assignment Window	Channel 1										
	Channel 2										
	Channel 3										
	Channel 4										
	Channel 5										
IR channel assignment Corridor	Channel 1										
(only valid for 2_channel control)	Channel 2										
	Channel 3										
	Channel 4										
	Channel 5										
Conections (controler to ballasts)	DALI 1	W	W	W	Ta	Ta	*	E	*	Ta	Ta
	DALI 2	C	C	C	Wa	Wa	*	Ca	*	Wa	Wa

No = No background level
P1 = Preset 1 (100% by factory default)
W = Window
C = Corridor
Ta = Task
Wa = Wall
* = Window = Corridor (DALI 1 = DALI 2)
E = Entrance
Ca = Cabinets
= LCC1656

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