eSMART

USER GUIDE

Fully PROGRAMMABLE control gear for LED modules

GU-001/05/18-EN

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1. INTRODUCTION

Thank you for choosing control gear for LED modules designed and manufactured by ELT (Especialidades Luminotécnicas S.A.U.). This user guide will help you learn about eSMART technology and configure your control gear so that it can be correctly integrated into your luminaire.

We advise you to check the latest available version of this document on the ELT website, **www.elt.es/en.**

1.1. The eSMART technology

Thanks to its functionalities and the programmable and configurable dimming methods it incorporates, control gear equipped with eSMART technology offers full flexibility in the design of the lighting system, perfectly adapting the luminaires to any application and surroundings where they are to be installed.

1.2. Applications

ELT drivers with eSMART technology are the ideal street lighting solution of today and tomorrow, achieving optimal efficiency in every lighting point, accompanied by the best operational features and maximum energy saving, which helps reduce both economic costs and CO_2 emissions into the atmosphere throughout the lifetime of the street lighting system.

These drivers can be used in an infinite number of applications such as street lighting, roads, monuments, sports facilities and industrial premises.

1.3. Classification and symbols

The nomenclature of eSMART control gear, taking an example the **iLC PRO 75/200…1400-XR**, is described as follows:

- iLC: Constant current control gear equipped with eSMART technology.
- PRO: All functionalities and programmable methods are available.
- 75: 75W of maximum output power.
- 200…1400: Constant current output in milliamps in which regulation is permitted.
- XR: Casing format.

1.4. General features of the drivers

The main features of the iLC control gear incorporating eSMART technology are as follows:

- Build-to-use drivers with insulation double or reinforced insulation. IP20 ingress protection.
- Suitable for installation in Class I and Class II luminaires.
- Wide range of input voltages.
- High power factor.
- Low harmonic distortion.

- Low standby power consumption.
- Low output ripple current.
- High quality light without flickering.
- Programmable by modulating output current size.
- Wide range of output current regulation.
- Configurable functionalities for an optimal lighting system design:
  - Adjustable output current (AOC).
  - LED module thermal protection (MTP).
  - LED module constant lumen output (CLO).
  - LED module end-of-life alarm (EOL).
  - Programmable start-up time (PST).
  - Monitoring parameters and events.
- Different regulation methods can be selected, adapting each lighting point to the needs of the installation:
  - DALI.
  - 1-10V / 0-10V.
  - ActiDIM: stand-alone and dynamic dimming system that adapts to night hours.
  - Tourist ActiDIM mode: this feature can be activated as part of the ActiDIM regulation mode, to establish exceptions to the stand-alone dimming during a specific period.
  - Parking mode: light regulation via presence detectors.
  - ActiDIM Parking: combines stand-alone dimming with presence detectors.
  - LineSwitch: lineswitch dimming.
  - MainsDIM: head-end dimming by varying the mains voltage.
  - ON/OFF: no regulation.
- Compatible with the STELARIA™ remote street lighting management system.
- Short circuit, overload and open circuit protection.
- Control gear thermal protection.
- Protection against grid variations and power surges.
- Electronic circuit fully protected against humidity.
- Excellent thermal performance and extensive working temperature ranges.
- Up to 100,000h lifetime.

1.5. Portfolio

Ref nº	Model	Version compatible with the STELARIA™ remote wireless management system
9916164	iLC PRO 25/200...1050-XR	9916165
9916153	iLC PRO 40/200...1050-XR	9916154
9916151	iLC PRO 75/200...1400-XR	9916152
9916155	iLC PRO 110/200...1050-XT	√
9916166	iLC PRO 150/200...1050-XT	√

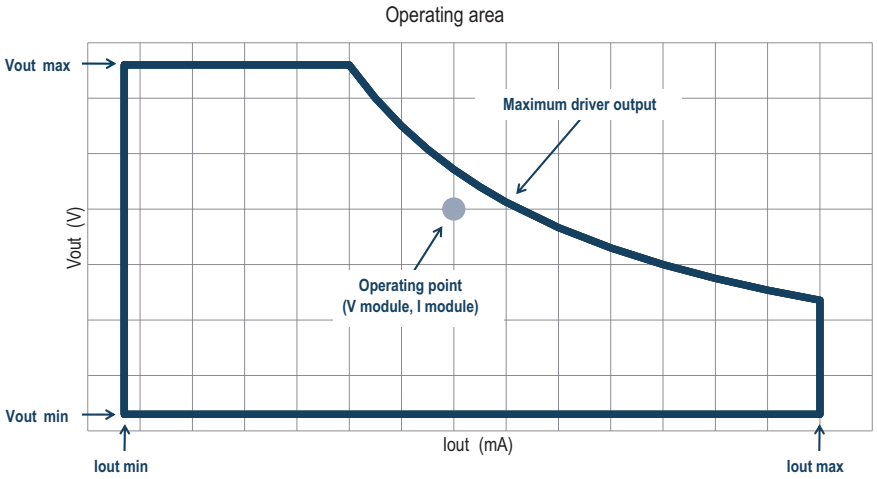
2. ELECTRICAL FEATURES

2.1. Electrical parameters

The iLC PRO control gear with eSMART technology has a very extensive operating area, perfectly adjusting the operating point required in the design of each luminaire and each lighting system. The result is full flexibility, easily adapting to the continuous and fast evolution being experienced by LED technology lighting.

The operating area of the drivers is defined by the maximum and minimum load voltage that can be connected, by the maximum and minimum output current that can be programmed and by the maximum working power.

The operating point is defined by the maximum voltage of the LED module to be connected and the current which it is going to supply. This operating point must be within the operating area of the selected driver.



In the iLC PRO family, the operating area of one model partially overlaps with that of the higher output model, ensuring a continuity that effectively responds to every operating point. When the defined operating point falls within the operating area of several drivers, selecting the device with the lowest assigned power will provide it with the best electrical output values in terms of THD, power factor and efficiency; while selecting the device with the highest assigned power will provide a lower working temperature and as such, a longer service life. Generally, if the luminaire has a good thermal design, the first option is usually the recommended selection.

The iLC PRO control gear with eSMART technology permits a wide range of the supply voltage that, in addition to becoming a solution suited to a host of installations, guarantee stable and reliable operation in the face of fluctuations in the values of the mains grid voltage.

In terms of efficiency, the power factor, THD and dimming range of the iLC PRO drivers are positioned in the high performance segment of the lighting sector.

NOTE:
The technical specifications of each model and their corresponding data sheets can be viewed and are available for download via the ELT website at **www.elt.es/en**

2.2. Electrical insulation

Control gear with eSMART technology has been designed in accordance with the EN 61347-1 and EN 61347-2-13 safety standards for double or reinforced insulation against electric shocks resulting from contact with accessible parts.

The insulation between the primary and secondary circuits, as well as between every circuit and the functional earth, is set out in the following table:

	Functional earth	Input voltage	DALI	0-10V	LED module/external NTC / STELARIA
Functional earth	X	Double	Double	Double	Double
Input voltage	Double	X	Main	Main	Double
DALI	Double	Main	X	Main	Double
0-10V	Double	Main	Main	X	Double
LED module/external NTC / STELARIA	Double	Double	Double	Double	X

NOTE:
When the devices are built into luminaires, the cabling between the different components must observe the insulation class for which these lighting fixtures have been designed, as well as comply with the EN 60598 standard.

3. THERMAL CHARACTERISTICS AND LIFETIME

The thermal operating conditions of the control gear are a critical factor for its lifetime and for the LED street lighting system into which it is integrated. This is why an understanding of the factors and parameters relating to this aspect is essential.

Control gear equipped with eSMART technology has been designed to offer maximum performance with the best thermal efficiency.

Once the drivers have been integrated into the lighting system, the thermal efficiency and lifetime depend on factors such as the connected load, luminaire design, its capacity to dissipate the heat generated inside the unit and the relative position of each of its components.

3.1. Temperature inside the casing (tc)

The parameter to control in order to ensure correct operation and life expectancy is the temperature inside the casing at a point called tc. The tc is a point of reference that represents the conditions under which the driver's internal components are working. Particular care must be taken to ensure that the maximum limits specified for each model are not exceeded.

The simplest way to measure the temperature at this point is by means of a thermocouple attached at the place indicated on the casing of each driver once thermal stability has been achieved.

NOTE:
The eSMART drivers from the PRO range incorporate a diagnostic mode that indicates the internal temperature value of the driver. This is for guidance purposes only as it does not necessarily coincide with the tc value.

3.2. Ambient temperature (ta)

The eSMART drivers have been designed to be able to operate within a very wide ambient temperature range. The maximum ambient temperature limit depends on the operating point, the value of the connected load and, largely, to the design of the luminaire itself and its ability to dissipate heat outwards.

The maximum permitted ambient temperature for control gear can serve as a guideline or an indicator of the conditions under which that device is able to work, however must not be used as the control parameter to guarantee its estimated lifetime.

With the aim of ensuring reliable ignition in ambient temperatures of less than -25ºC, the drivers power up gradually, applying a start-up process that lasts for a maximum of 10 seconds. Gradual start-up takes place irrespectively of the driver configuration.

3.3. Lifetime

The eSMART control gear can achieve up to a 100,000 hour lifetime depending on the working temperature at point tc.

NOTE:
Thermal data and the lifetime of each model can be viewed on their corresponding data sheets, available for download via the ELT website at **www.elt.es/en**

4. PROTECTION

The eSMART technology control gear from ELT is equipped with internal protection to ensure that the drivers and every component of the luminaire in which they are installed operate correctly.

4.1. Short circuit protection

In the case of a short circuit in the load terminals, the driver disconnects the power and goes into protection mode, in which it remains as long as the fault continues. This protection automatically resets so that when the short circuit is resolved, the driver comes out of protection mode and reconnects to the power supply.

4.2. Overload and open circuit protection

In the event of an overload or open circuit, the driver disconnects the power and goes into protection mode.

When occasional situations of overload or open circuit are identified in the output terminals, the protection mode automatically resets. This means that once the fault is resolved, the driver comes out of protection mode and reconnects to the power supply.

Should overloads or open circuit events repeat over time with a high level of frequency, or if such events persist, protection mode will not automatically reset and it will be necessary to disconnect the mains power for at least a few seconds.

If the driver is connected at a load lower than that permitted for the operating area, it will flicker as long as it remains connected.

4.3. Thermal protection

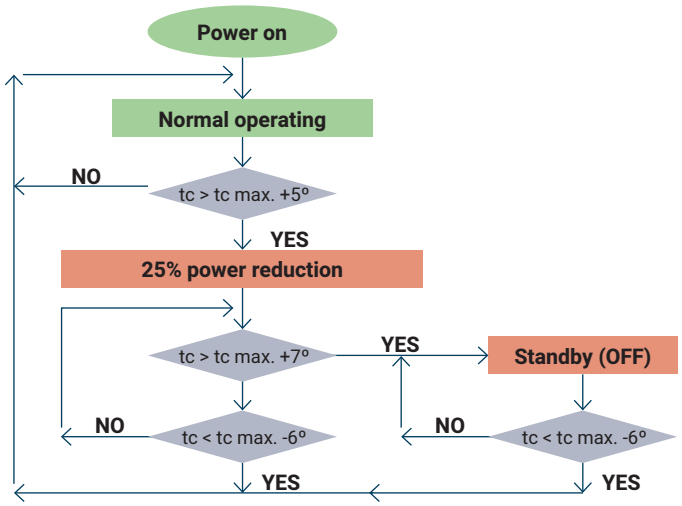
Drivers with eSMART technology benefits from thermal protection, meaning that when a temperature excess is detected, the power supplied is reduced or even switched off.

If, under normal operating conditions, the temperature at tc exceeds its maximum permitted value by 5ºC, the driver will reduce the power supplied to the load by 25%.

If, during power reduction mode, the temperature at tc continues to rise until it exceeds its maximum permitted value by 7ºC, the driver disconnects the power.

While in thermal protection mode, having reduced or cut off the power, if the temperature at the tc reduces to 6ºC or lower than its maximum permitted value, the driver will return to its initial normal operating mode.

This process is illustrated in the flowchart on the following page:



4.4. Out-of-range mains voltage protection

In the event of a low mains voltage value that is between the permitted minimum and the brownout value, the driver will remain on. If this situation continues over time resulting in over-heating, the driver will reduce the power supplied to the load and even disconnect it in extreme cases.

In the event that a mains voltage value is less than the brownout value, the driver switches itself off for protection.

In the event that a mains voltage is above the maximum permitted value, the driver will remain on, generating stress on its internal components and potentially affecting its lifetime. Possible adverse effects are increased the greater the value and the longer the time that the power surge continues.

Even though the drivers are able to withstand power surges of 380Vac for 2 hours, extreme care must be taken to avoid this type of situation.

4.5. Shock wave protection

Drivers equipped with eSMART technology from the PRO range are designed to offer improved protection of the supply terminals against shock waves such as those caused by radio storms. They benefit from levels of protection, in both differential and common modes, that are higher than the minimums defined by the immunity requirements for lighting equipment under EN 61547.

- Protection in differential mode (L - N): 6kV / 3kA
- Protection in common mode (L - Earth / N - Earth): 8kV

If higher levels of protection are required, external devices can be added to the luminaire or to another point in the street lighting installation.

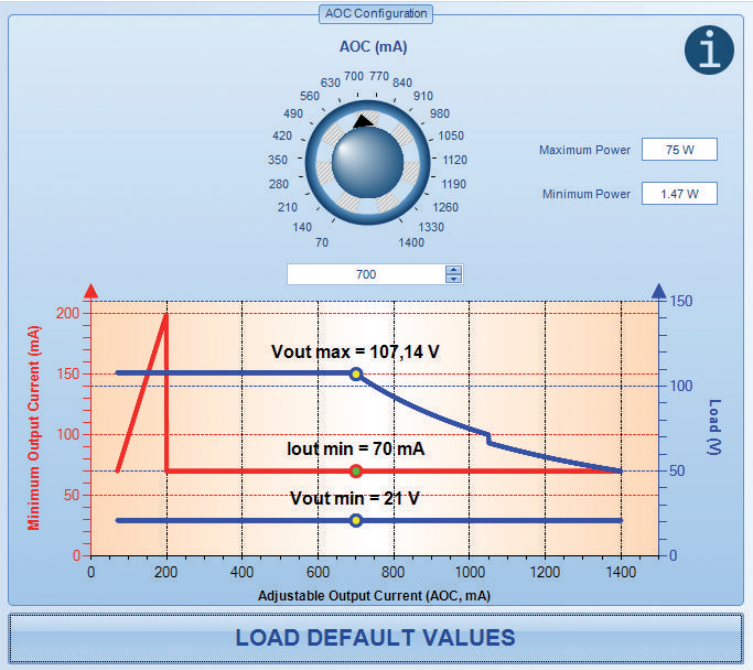
NOTE:
Fault conditions and the response of each model can be viewed on their corresponding data sheets, available for download via the ELT website at **www.elt.es/en**

5. FUNCTIONALITIES

5.1. Adjustable output current (AOC)

The adjustable output current (AOC) is a feature that configures the nominal value of the output current from a driver with eSMART technology.

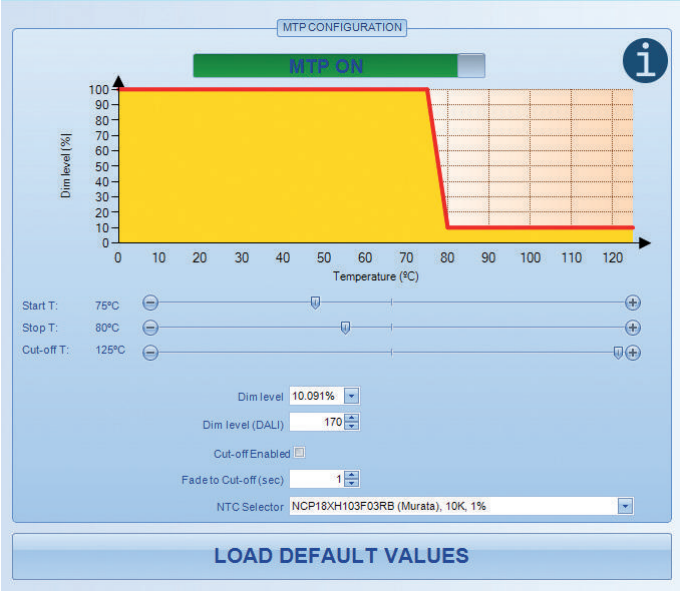
The output current value selected is understood to be the nominal value used to achieve 100% of the light level in any of the selected dimming modes that can be programmed within the entire permitted range.



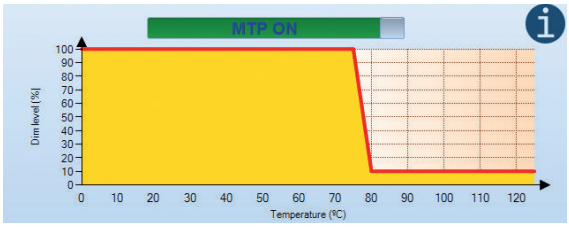
5.2. LED module thermal protection (MTP)

This feature activates a thermal protection for the LED module, controlling its temperature via an external NTC located inside the module itself.

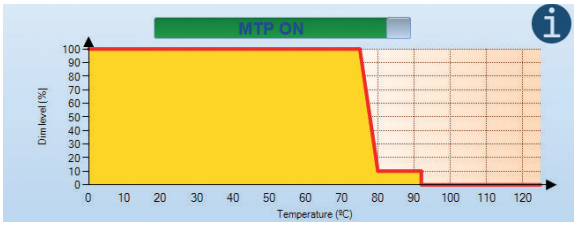
It has to be configured so that the driver regulates the output when the reading provided by the external NTC indicates that the temperature at the tc point of the LED module has exceeded the maximum value that guarantees its expected lifetime. The parameters to be defined are the “start temperature”, the “stop temperature” and the “dimming level”.



The “cut-off enabled” option can be activated which makes the driver turn off the LED module if the read temperature exceeds a value defined as the “cut-off temperature”.



Cut-off temperature deactivated



Cut-off temperature activated

In the event that the LED module switches off because it has reached the “cut-off temperature” value, the driver automatically switches back on at the maximum dimming level when the read temperature is 5ºC below the “start temperature”.

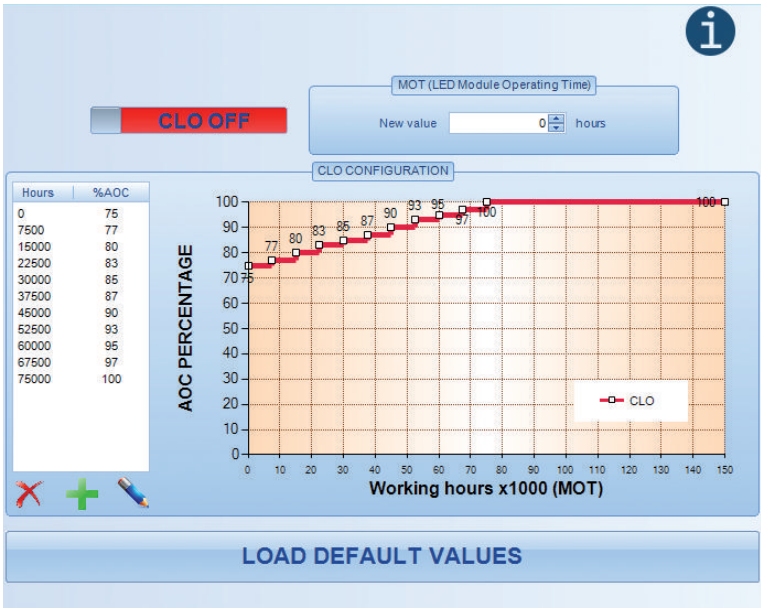
So that the values of the measured temperatures are correct and can be handled by the driver, an external NTC has to be selected and used from one of the following four commercial references:

- NCP18XH103F03RB, 10k, 1%, 0805, MURATA.
- NCP15XW153E03RC, 15k + 390R series, 3%, 0402, MURATA.
- NCP18XW153J03RB, 15k, 3%, 0402, MURATA.
- NTCS0805E3153GMT, 15k, 2%, 0805, VISHAY.

WARNING: connecting active signals to the external NTC terminals could run the risk of a breakdown.

5.3. LED module constant lumen output (CLO)

This feature allows a gradual increase curve of the output current over time to be defined for the constant lumen output depreciation of the LED module.



To correctly use and configure this functionality, the depreciation curve of the LED module lumen output to be supplied must be known. This curve can differ for the different LED modules on the market and depends on both the operating point and the thermal conditions under which it is working.

Based on this information, a table can be defined to incrementally assign an output current value for each operating interval, so that the loss of LED module lumen output during that period is compensated.

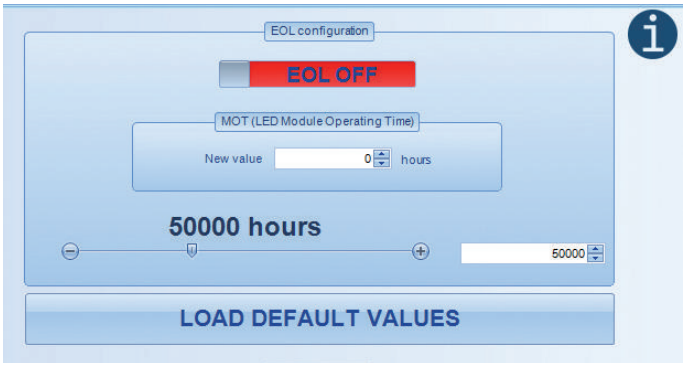
The output current value can be assigned in increments of 1% within a range from 0 to 100%, where 100% is the value defined by the AOC. The intervals can be configured in steps of 500 hours.

To synchronise the compensation curve configured by the CLO with the actual lumen output depreciation, the MOT parameter, “the LED module operating time”, must be entered so that it coincides with the actual operating hours of the LED module.

WARNING: The MOT value is also used for the EOL functionality.

5.4. LED module end-of-life alarm (EOL)

This functionality provides a visual signal indicating that the LED module has reached the end of its lifetime and as such, its replacement is recommended.

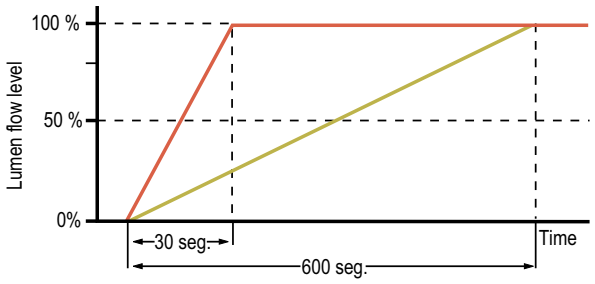


To configure this functionality, the number of hour's life expectancy for the LED module has to be selected in addition to the actual time that the module has been working.

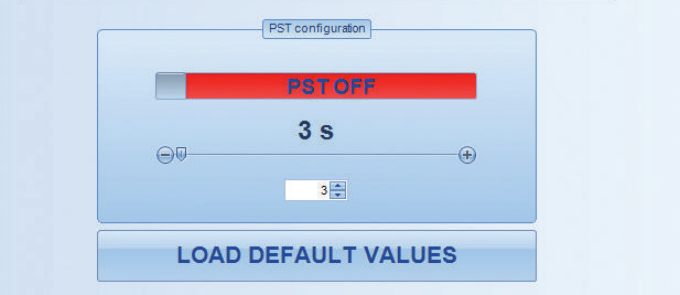
The driver will make the LEDs flicker for 3 seconds after power-on when the actual operating time reaches the expects lifetime, after which it will continue its normal operation.

5.5. Programmable start-up time (PST)

This feature is able to configure a smooth and pleasant start-up, avoiding an abrupt sensation when the street lighting switches on.



Activation of the PST functionality can only take place in the ON/OFF, 1-10V and 0-10V modes. Start-up duration, from the moment the mains voltage is switched on to achieving 100% output current, can be configured between 3 and 600 seconds, in increments of 1 second.

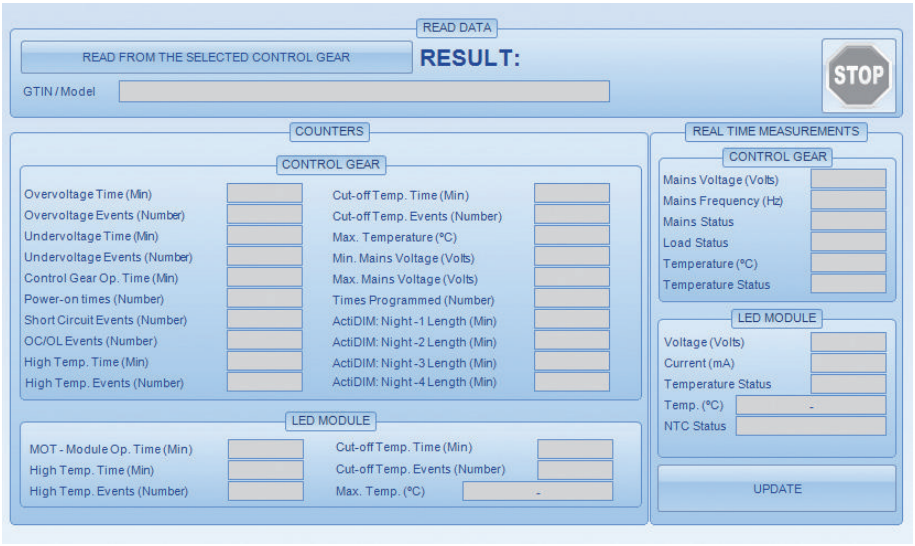


NOTE:
Configuring a smooth start-up using the PST functionality does not reduce the peak and width values of the inrush current.

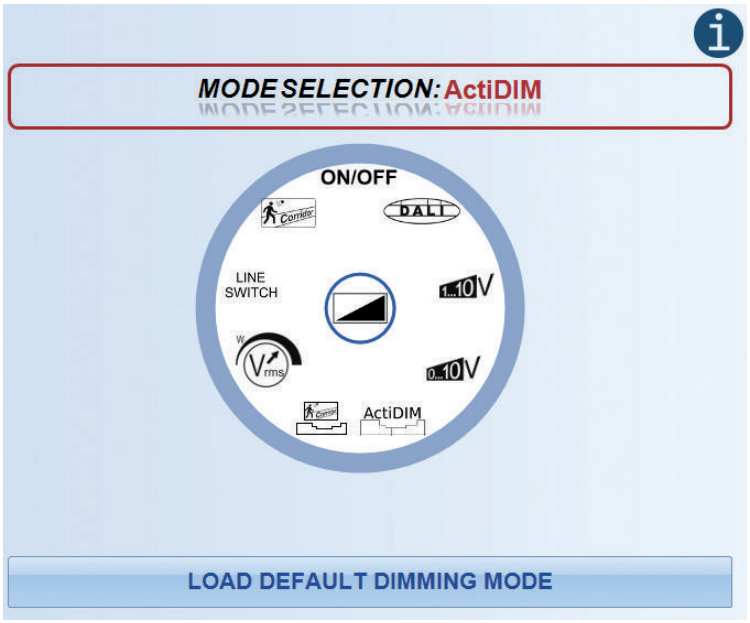
5.6. Monitoring parameters and events

Control gear equipped with eSMART technology records numerous events in its non-volatile internal memory along with the maximum and minimum values of different parameters and operating times in different modes, relating to the control gear itself as well as to the LED modules its drives.

Real time data recorded and the parameters can be monitored by the user via the iSOFT configuration software and by means of the STELARIA™ remote street lighting management system.



6. DIMMING METHODS



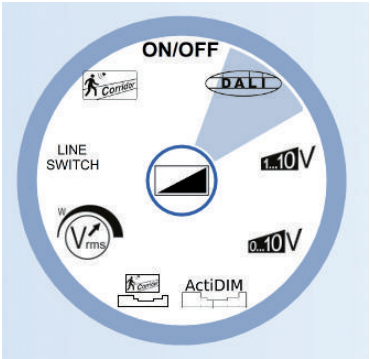
Control gear with eSMART technology is able to select the most suitable dimming method for each application. The choice of a specific dimming mode activates its configuration parameters and deactivates other dimming methods.

Dimming is achieved through the amplitude modulation (AM) of the output current, obtaining flicker-free light at each regulation point

The main features of each method are explained below.

6.1. DALI mode

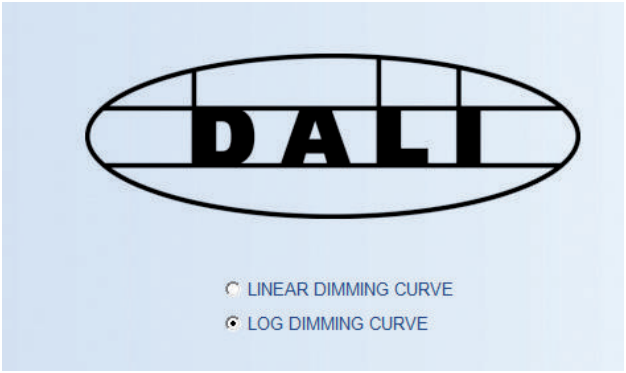
DALI (Digital Addressable Lighting Interface) is a digital and addressable communication interface for lighting systems, standardised in line with EN 62386 that guarantees the correct operation between devices produced by different manufacturers.



Communication between programmable control gear and other DALI devices (sensors, control panels or other peripherals) takes place via two cables and is two-way, enabling dimming, configuration and consultation commands to be sent.

By selecting this method, the user can choose between a logarithmic or linear dimming curve.

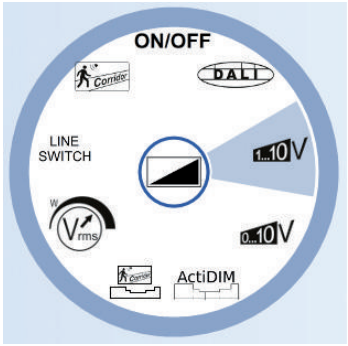
All the information relating to this dimming system is explained in the DALI standard in line with which the eSMART technology drivers have been designed.

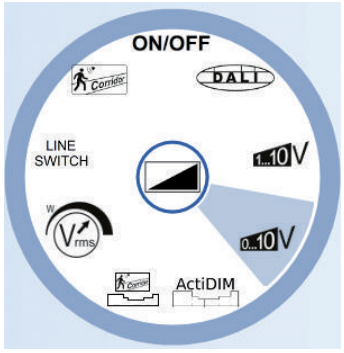


6.2. 1-10V / 0-10V mode

This dimming system is able to vary the light flow by means of an analogue control signal that reaches the drivers via an additional two-wire control line, whose positive and negative polarity must be observed when making the connection.

This one-way system, in which the control information only flows from the controller towards the control gear, is not addressable, given that every device connected by cable to the control line reacts to a set point.





The analogue control signal is a continuous voltage level within a range from 0V to 10V. This signal can be obtained directly from an active control device (analogue control cards or power supply sources) or indirectly from a passive control device (variable resistance or potentiometer) through which the output current generated by the devices in their control terminals circulates.

To ensure that these active control devices work correctly, they must have the capacity to absorb a quantity of current greater than that generated by all the connected devices together.

Nº of devices to control x Maximum output current of the 1-10V / 0-10V control terminals

Where a potentiometer is used for regulation, this device must have the resistance value indicated in the electric input parameters of the driver. When various devices are going to be connected to the same potentiometer, the following formula has to be applied to calculate its resistance value, adequately sizing it in terms of the power to dissipate.

$$\text{Potentiometer value} = \frac{560\ \text{k}\,\Omega}{\text{nº devices in parallel}}$$

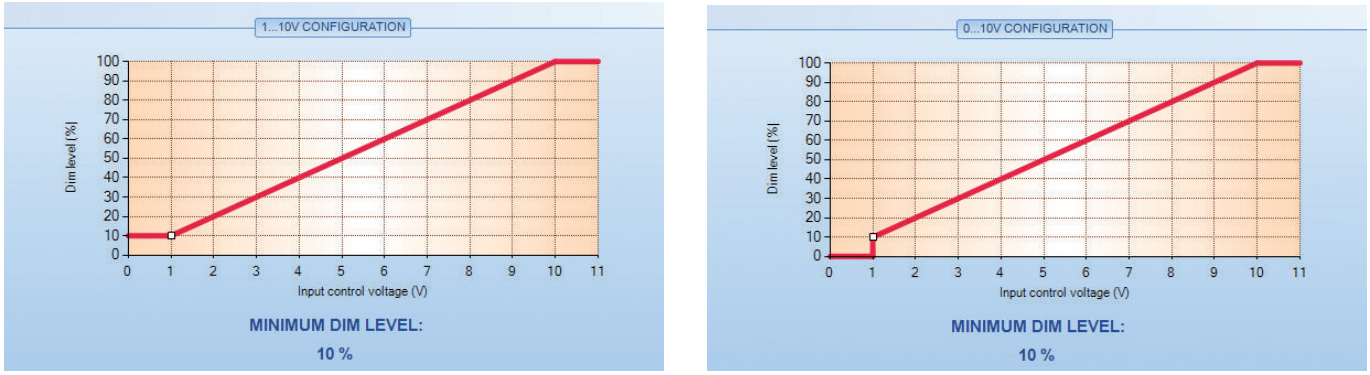
The ratio of the resistance value of the potentiometer compared to the control voltage level and the light regulation level generated is not linear, which means that logarithmic control potentiometers can be used to improve the dimming experience.

The use of active control elements that generate the analogue 0-10V signal is the recommended option over the use of passive elements such as a potentiometer in cases where stricter control is required over the regulation point or where the device is expected to work in extreme temperature ranges.

The response of the 1-10V dimming differs slightly to the 0-10V.

In 1-10V dimming, the maximum dimming level is obtained by leaving the control terminals in open circuit or with a signal equal to 10V. This is the 100% level and cannot be configured. The minimum level, however, is obtained by short-circuiting the control terminals or via a signal lower than 1V and this may be configured.

0-10V dimming is almost the same as that for 1-10V except that the drivers can enter into standby mode when the control terminals are short-circuited or with a signal that is very close to 0V. The standby output is guaranteed for values higher than 1.5V.

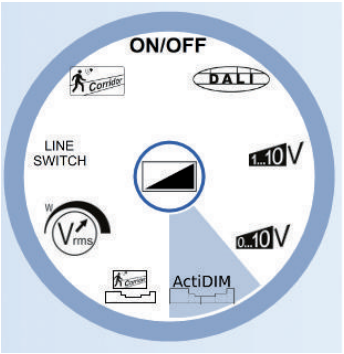


Example 1-10V and 0-10V dimming curves

Within the temperature ranges at point tc between -40ºC and -30ºC the driver will remain at the maximum level regardless of the signal in the control terminals. However, the driver will respond to the set points as it enters standby if the selected dimming mode is 0-10V.

NOTE:
Drivers from different manufacturers may produce different responses to the same control signal value.

6.3. ActiDIM mode

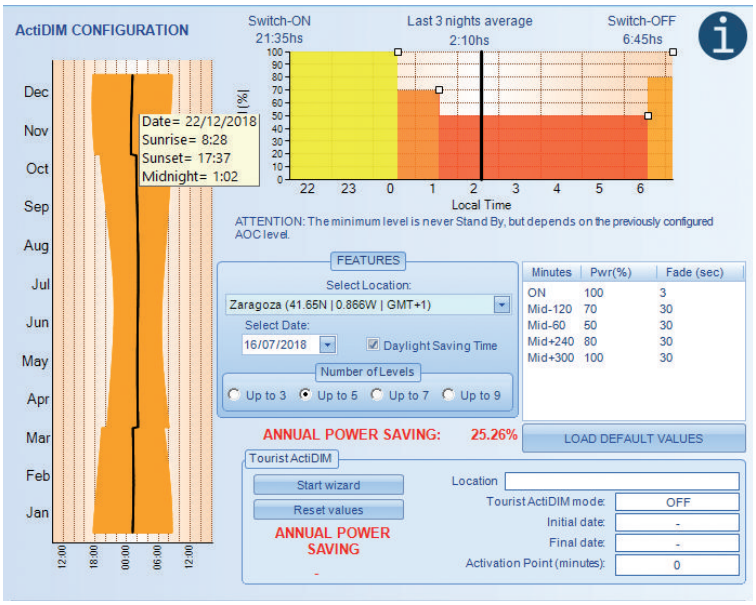


The ActiDIM operating mode is a stand-alone dimming system that simulates astronomical behaviour to provide energy saving without the need to wire in a control line.

The automatic dimming algorithm controls the times at which a change of light level has to take place. It takes as a reference the average night time duration point, calculated based on the average of the last three nights. The duration of each night is defined as the time measured from when the street lighting is switched on to the time it is switched off.

NOTE:
When the lighting is switched on for less than 4 hours (for example, to carry out maintenance tasks or during power outages) and in cases where it is on for more than 20 hours, the control gear does not memorise that period as a 'night' and therefore does not take it into account when applying the ActiDIM calculation algorithm.

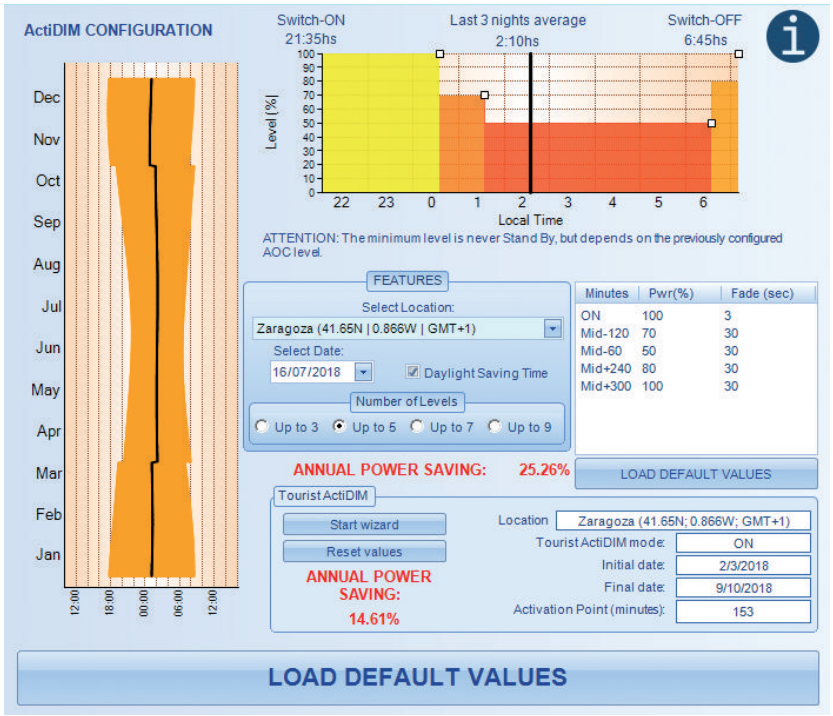
This system is able to configure different dimming profiles, selecting up to maximum of 9 levels, their value, the duration of the transitions and the changes between them.



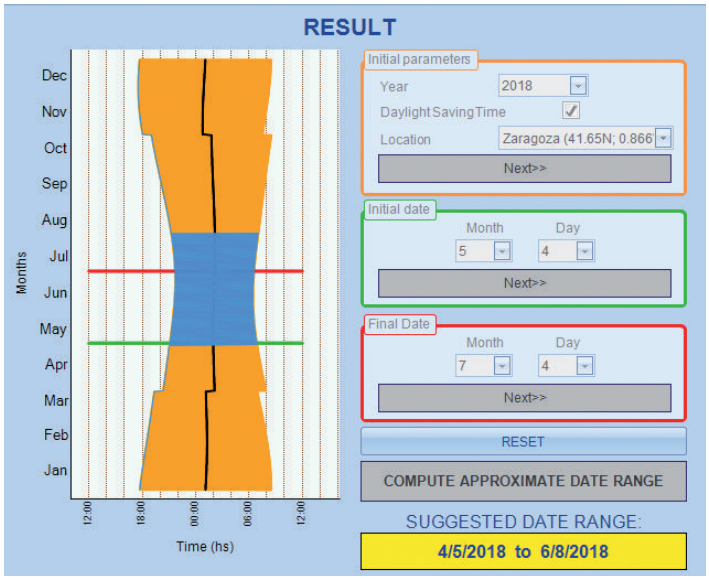
Tourist ActiDIM mode

This option is recommended for situations that require total or partial deactivation of the dimming profile established by the ActiDIM operating mode during the night over one period of the year, defined on an approximate basis, in a specific location.

For example, in summer, the initial dimming parameters defined for the period up until midnight are cancelled, so that the driver operates at maximum power up to that point, before continuing to follow the profile established under normal ActiDIM mode.



This function offers added value to the standard ActiDIM mode, as it allows the luminaire to operate with two different behavioural patterns with no need for control cabling to change from one mode to the other.

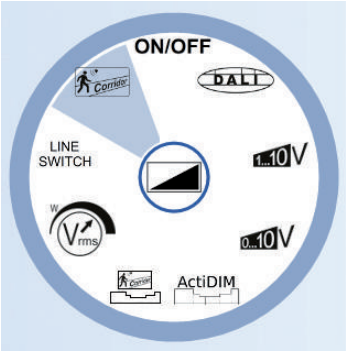


A wizard will guide you through the configuration once it has been activated, so that you can decide to use it if the outcome achieved suits your application.

NOTES:

- The tourist ActiDIM mode is not a “calendar” function that allows the exact selection of a range of dates. This mode offers periods with variable durations depending on the dates entered for a specific location. The results obtained from its application cannot be adjusted.
- The periods proposed by the application during configuration of the driver are based on the hours of dawn and dusk calculated by the astronomical clock algorithm built into the configuration software. There may be one minute of difference to the astronomical clocks of each installation.
- In installations where switching the street lighting on and off is significantly ahead or behind the time set by the installation’s astronomical clock or if other methods such as photocells are used, the tourist ActiDIM mode may not provide the expected response.
- The best results are obtained the wider and more focused the date range selected, as regards the solstices, in locations far away from the equator, when the installation is switched on and off at dawn and dusk as indicated by an astronomical clock that is not fast or slow.

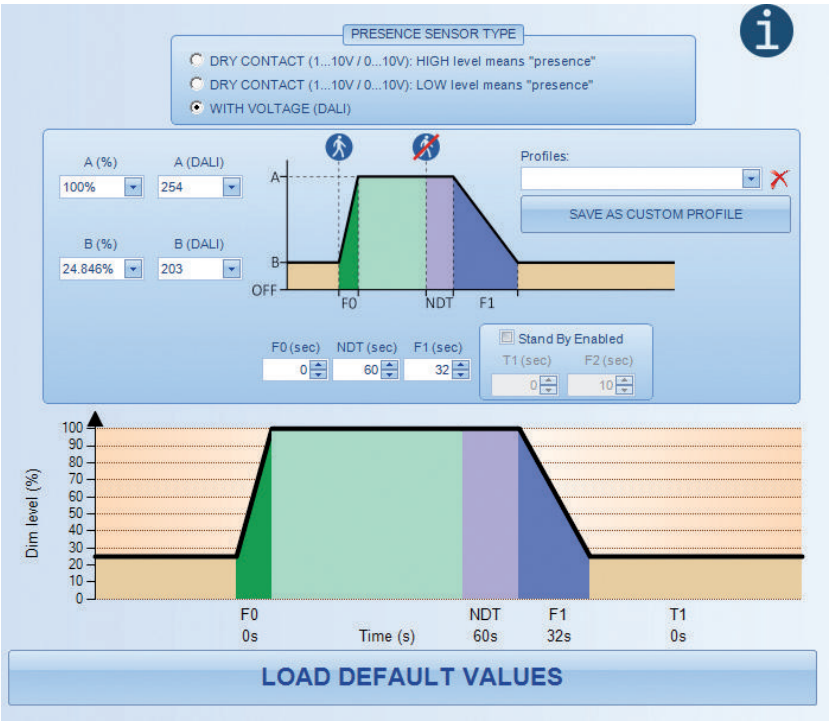
6.4. Corridor / Parking mode



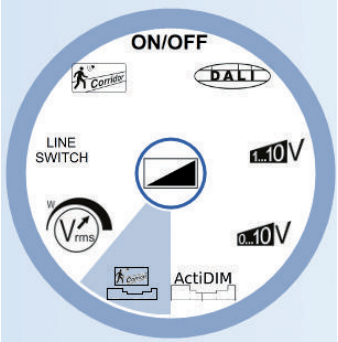
In Parking operating mode, dimming takes place through the installation of a presence detection sensor. This dimming method is suitable for street lighting in areas where high light levels are only required when some form of presence is detected, such as in parks, car parking areas, cycle lanes, etc.

The eSMART technology control gear is able to connect presence detection sensors that return the detection signal by means of a dry contact connected to the 1-10V control terminals, or via a voltage level that has to be connected to the DALI control terminals. The type of output offered by the sensor to be used must first be selected using the iSOFT configuration tool.

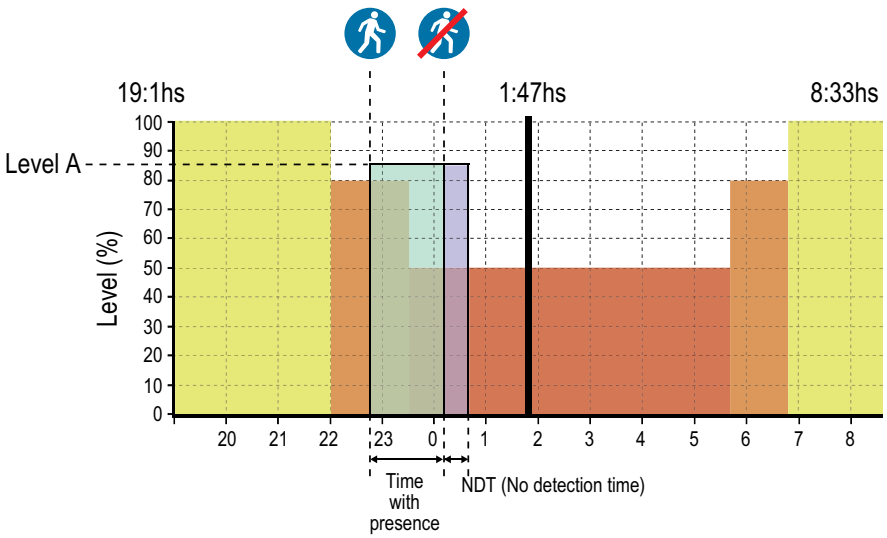
Other parameters to configure are the dimming levels of the standby and detection statuses, the transition times between these statuses and the time it remains at detection level after which it fades out.



6.5. ActiDIM mode with Corridor / Parking

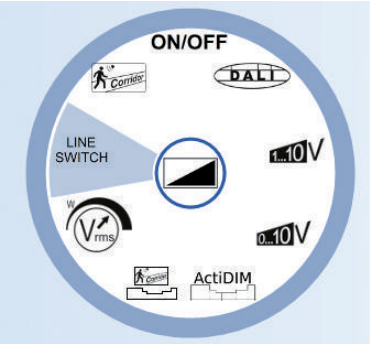


The eSMART technology drivers are able to combine the ActiDIM mode functionality with the Parking mode by installing a presence detection sensor. This mode is ideal for areas that require an active energy saving profile, such as the one offered by ActiDIM, but which need a high light level when a presence is detected, for example on zebra crossings.



NOTE:
If, in the event a presence is detected, level A configured by the Parking mode is lower than the actual level of the ActiDIM mode, the ActiDIM level will prevail.

6.6. LineSwitch mode

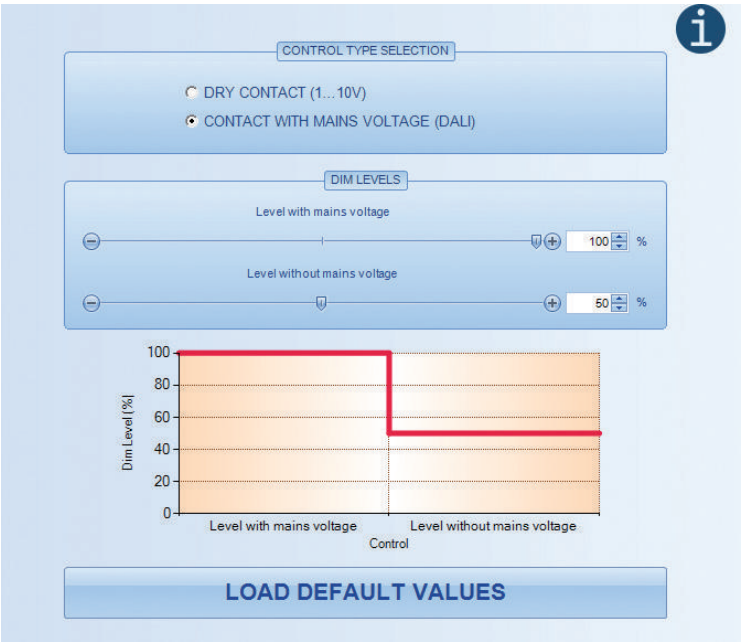


This operating mode is able to activate a dimming level via a line switch.

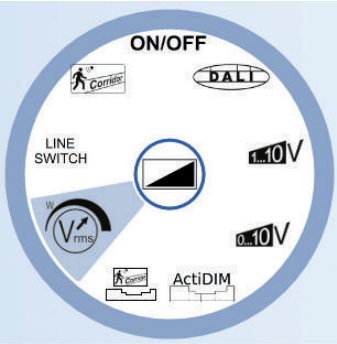
The eSMART control gear can select the type of line switch used from two options: those based on a dry contact and those whose contact is controlled via the mains voltage.

When the line switch option based on a dry contact is selected, the driver connection has to be made in the 1-10V control terminals. If the chosen option is a line switch with mains voltage, the connection has to be made in the DALI control terminals.

In both cases, the required dimming level can be configured when the signal in the control line is detected or when it is not receiving. As a result the installation can be adapted to the desired dimming value in each case, defining the control “logic”.

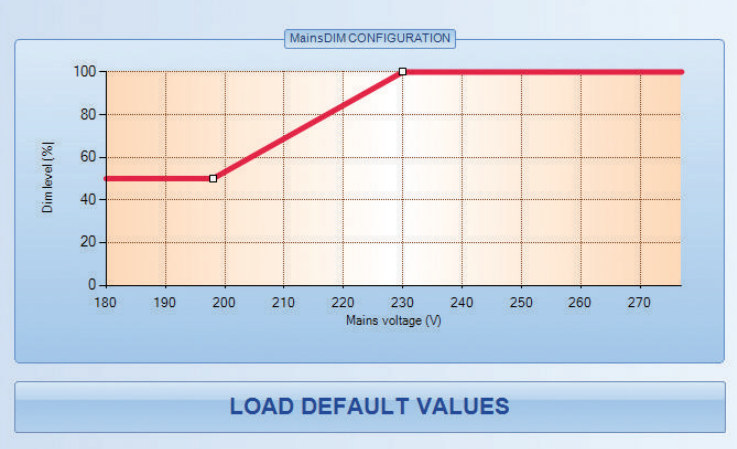


6.7. MainsDIM mode



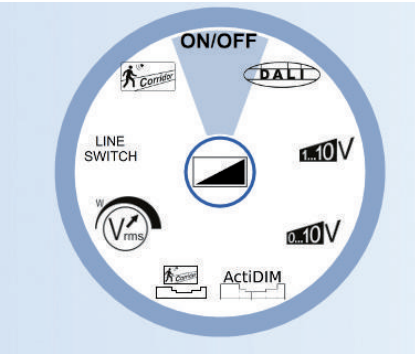
This operating mode can regulate the light level by varying the supply voltage of the control gear. The installation of a stabilised terminal voltage regulator is recommended.

The dimming curve is easy and intuitive to configure in a graphic format via the iSOFT configuration software.



NOTE:
The use of this dimming method is recommended for installations with a peak value factor of 1.4142; supply voltages with peak factors other than the above will cause variations to the measurement of the mains voltage made by the control gear and as such, will create an advanced or out-of-phase action as regards the true RMS value.

6.8. ON/OFF mode



The driver can be configured in ON/OFF mode where no type of regulation is required. This mode configures the PST parameter for enhanced visual comfort while the luminaire powers on.

If the user configures the driver with an output current below 200mA by means of the AOC functionality, the driver will enter ON/OFF mode by default and no type of regulation will be allowed.

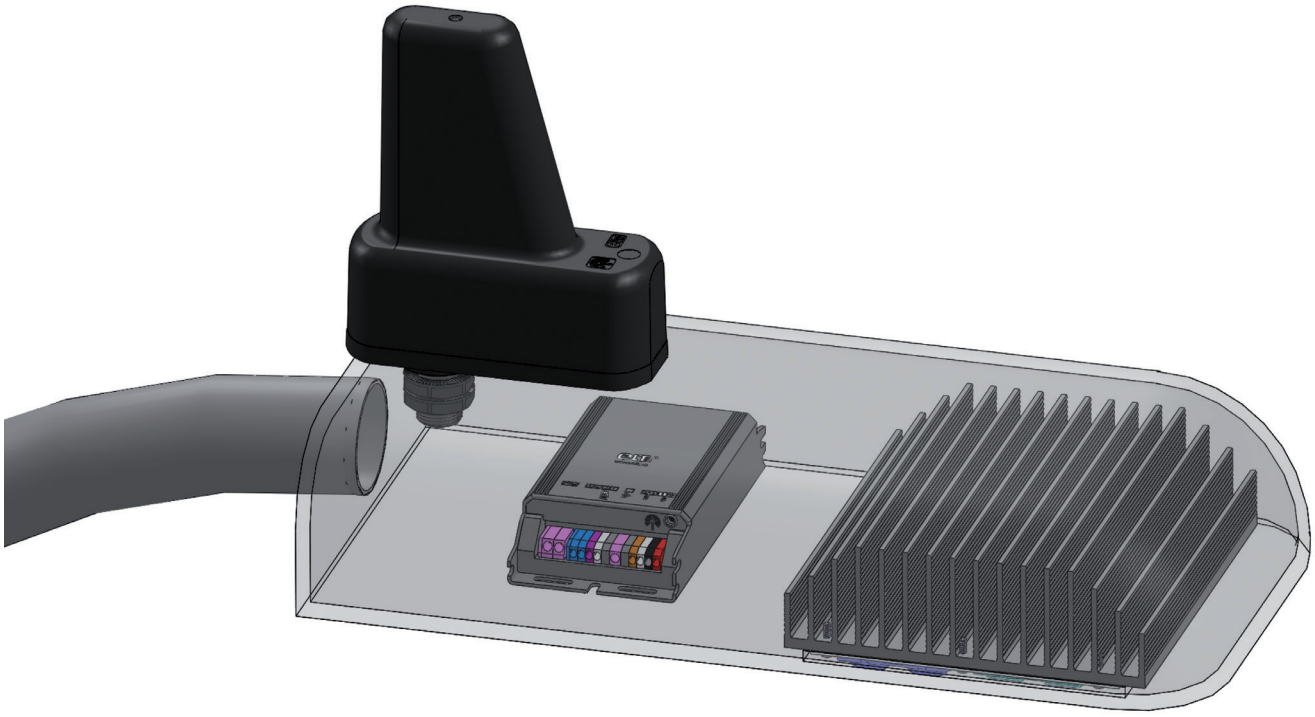
7. STELARIA™ REMOTE STREET LIGHTING MANAGEMENT SOLUTION

STELARIA is a wireless point-to-point remote street lighting management system developed by ELT that showcases the features and functionalities of drivers equipped with eSMART technology, enabling remote control and monitoring of the luminaire's operation by means of the driver.

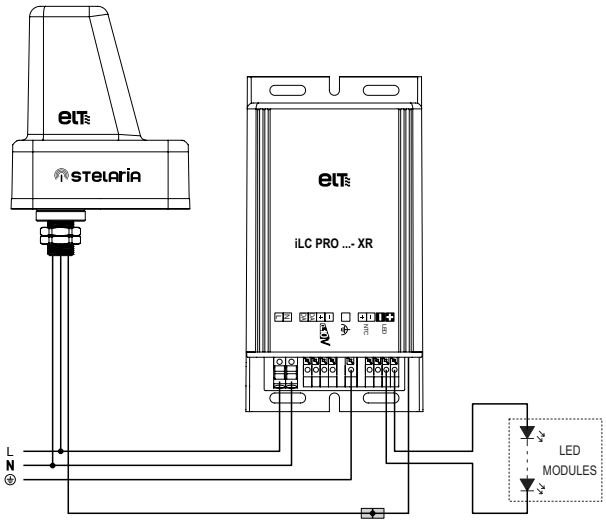
This powerful and integrated solution incorporates the software, hardware and communications necessary to remotely control and operate outdoor lighting systems.

STELARIA®

To be able to use this system, each luminaire has to be equipped with an eSMART driver in the version fully compatible with STELARIA, as well as with a STELARIA wireless communications node, usually installed on the outside of the luminaire, as illustrated in the following image:



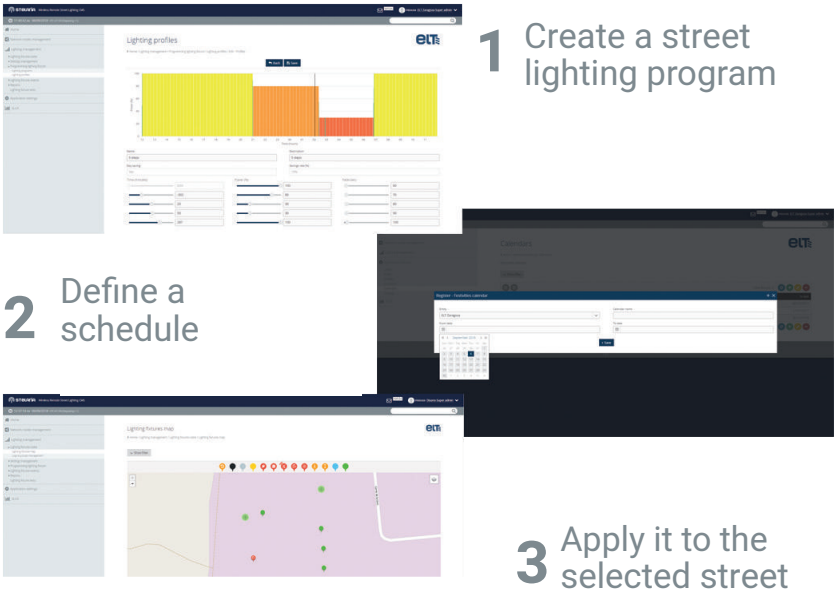
The STELARIA wireless communications nodes are robust and durable, UV resistant, watertight (IP67) and weatherproof. They are easily attached to the outside of the luminaire by means of an integrated 20 mm wall bushing, with connections to the luminaire's power supply and to the STELARIA communications port built into the driver, as shown in the following diagram:



To give the user operational control of the luminaires, STELARIA offers an online lighting control based on a user-friendly, reliable and secure web application. This can be accessed at all times and from anywhere, from any device connected to the internet, providing accurate and immediate control of the street lighting infrastructures.

Main system features:

- Point-to-point wireless control of each luminaire.
- Luminaire geolocalisation and inventory (multiple map selection).
- Simple configuration of levels and lighting periods in easy steps.
- Creation of individualised street lighting schedules for each luminaire.



- Energy consumption metering.
- Mains power supply monitoring.
- Monitoring the most relevant parameters of the driver (temperature, output voltage, output current, load voltage…).
- Monitoring relevant parameters in the light source (LED module): temperature (in the event the LED module includes an NTC probe), voltage and current in the module.
- Reports, alarms and system events.
- Register of operating hours.
- Simple management and classification of luminaires by city, street, coordinates, type.
- Maintenance planning.
- Administration of multiple users, roles and installations.
- Acquisition and handling of data in the cloud.

The architecture and technologies of the STELARIA system can also be personalised (on request) in order to acquire, process and visualise data originating from sensors linked or not to the lighting as well as the exchange of information with the management platforms of other urban services, including e-administration, water treatment, waste, the environment, etc. as part of the IoT ecosystem.

NOTE:
For more information, please visit **www.elt.es/en/stelaria-remote-wireless-street-lighting-cms**

8. INSTALLATION

8.1. General observations

The constant current power supply drivers for LED modules use sensitive electronic components. They have to be handled and manipulated with care, as with any other electronic equipment.

The installation, maintenance and replacement of the drivers must be carried out by qualified personnel, strictly in line with the given instructions for the product and current regulations, in order to achieve the correct level of durability and operation for both the driver and the LED module it supplies.

To guarantee protection against electric shocks during any intervention involving the driver, the power supply must be disconnected

8.2. Installation in luminaires

The eSMART control gear, classified as “build-to-use” drivers, must be installed inside the luminaire or in other housings that guarantee protection from environmental conditions such as humidity, water, snow, ice and dust. ELT recommends the use of luminaires with a minimum protection rating of IP54, however depending on the application, higher protection levels may be necessary.

The luminaires, as well as the entire street lighting system, must provide adequate protection against electric shocks. The eSMART control gear is categorised as equipment with “double and reinforced” insulation and is suitable for installation in both Class I and Class II luminaires.

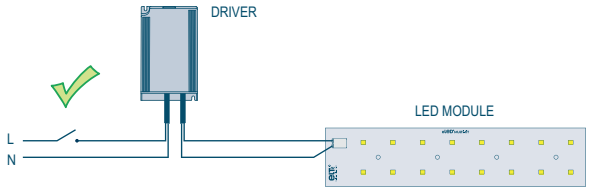
Insofar as it is possible, they must be installed away from heat sources and be fitted to maximise heat dissipation.

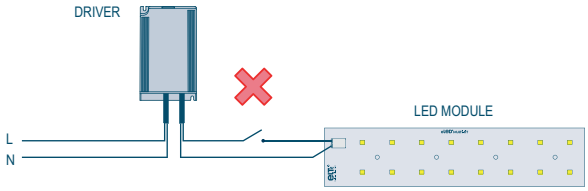
8.3. Connecting the drivers

To ensure that the eSMART drivers are correctly connected and work properly, the following instructions must be taken into account:

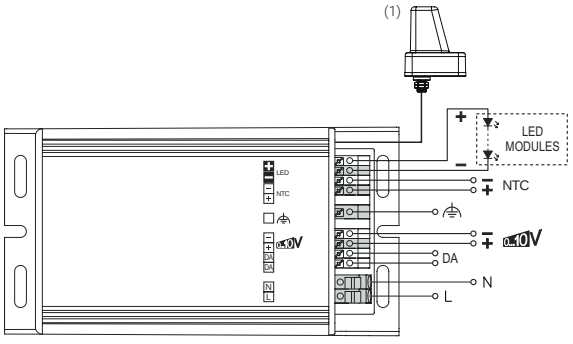
- Do not exceed the permitted ranges for the electrical input and output values for the different connection terminals of the drivers.
- The polarity indicated on the labelling must be observed at all times.
- DC operation is only allowed for equipment that has been specifically designed for the purpose.
- In three-phase 400V installations, ensure that the neutral is always connected. If this connection is broken, the 400V could reach the equipment, with the consequent risk of a breakdown. During installation, the distribution of loads between phases must be balanced out as much as possible.
- The stripped length and cable section indicated on the equipment labelling must be respected for each connection terminal.
- The maximum length of the cabling of the input terminals is limited by the brownout that takes place in it, so that it complies with current regulations and standards. As such, it depends on the cable sections used and the current circulating through them, which is established by the number of devices connected. Specifically, where DALI communication is used, it must never exceed 300 metres without using repeaters or signal amplifiers.

- As regards the output terminals, the equipment should be installed as close as possible to the LED module. In the event that external NTC connection terminals are used to protect the module via the MTP functionality, the maximum recommended length is 60 cm to avoid problems of interference and to achieve a more accurate measurement. In any event, for correct operation, the maximum accepted distance between the driver and the LED module is 2 metres.
- The connection cables must be appropriately insulated for the working voltage and comply with the level of protection against electric shocks provided by the street lighting system.
- To avoid damaging the driver connectors, press the connector drive carefully when inserting or removing a cable.
- Ensure that the chassis and other internal metal parts, such as assembly plates, supports or dissipaters, are always connected or electrically isolated. Make a reliable electrical connection between them by using serrated washers and sufficiently tightened screws, ensuring that the connecting cables are as short as possible to minimise inductances and thereby maximise their efficacy.
- In Class I luminaires, the protective earth conductor is strictly compulsory. Connect the protective earth to the chassis and to the internal metal parts.
- In Class II luminaires, ELT recommends installing an equipotential connection or a star configuration functional earth conductor between the chassis and every inaccessible conductive element of the lighting fixture, to avoid issues with electromagnetic compatibility, to reduce residual brightness in the LED modules in standby mode and to provide protection against shock waves.
- The installation of a switch at the driver output is not allowed as this could damage the LED modules as well as the driver itself.

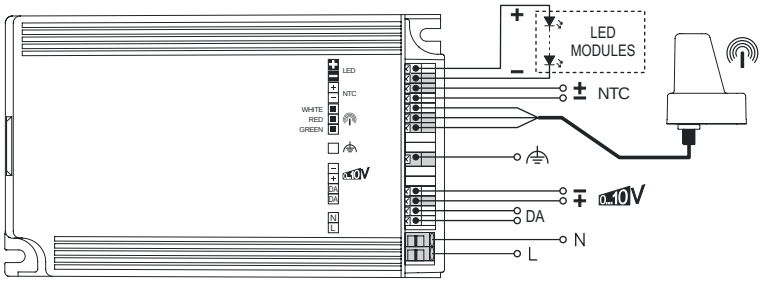




iLC PRO connection diagrams



-XR format



-XT format

(1) Option connection to the STELARIA™ Remote Street Lighting Management System. See references on page 5.

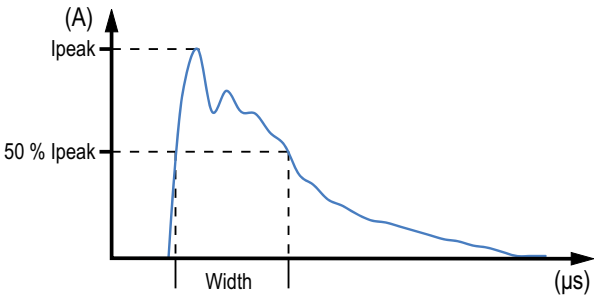
8.4. Protective switches

Each group of drivers has to be protected by an automatic circuit breaker and, in Class I installations, by a single-circuit trip switch.

The eSMART drivers are resistant to temporary power surges as specified in the regulations and must be installed in independent circuits separated from other inductive loads such as inductive ballasts, motors, etc

Automatic circuit breaker

The moment the control gear is connected, the driver's condensers create a high pulse of current that lasts for a very short period. This is called the inrush current.



The simultaneous ignition of several drivers can activate the protective automatic circuit breakers, which is why depending on the type and features of each, ELT recommends the installation of a maximum number of drivers.

The inrush current values and the maximum number of drivers that can be connected to each automatic circuit breaker can vary depending on the nominal voltage and impedance of the grid to which they are going to be installed.

These values, which can be viewed on the specific data sheets for each reference, have been empirically obtained using the set-up and measurement method proposed under the draft standard IEC 63129, for a 277V AC reference power grid as defined under NEMA standard 410 with a line impedance of 450mΩ and 100µH.

The inrush current values of the control gear will reduce, thereby increasing the number of drivers to be connected to each circuit breaker; the lower the voltage, the greater the impedance of the power grid (and vice versa). As such ELT recommends that it is checked for each installation.

Steps can be taken to reduce the effects of the inrush current, such as the use of external devices to limit it; carrying out a sequential ignition of the control gear; dividing the installation into different circuits; or selecting automatic circuit breakers with a less sensitive response curve

NOTES:

- The maximum number of drivers that can be connected to an automatic circuit breaker will be the most restrictive value that is obtained from the evaluation of the inrush current and the maximum connected load.
- Configuring a gradual power-on via the PST functionality does not reduce the peak and width values of the inrush current.

Single-circuit trip switch

The interference suppression filters of the LED control gear is designed to earth interferences in the form of leakage current, whose typical value is less than 0.5mA in eSMART drivers.

The total leakage current of the luminaire can be greater because of the current introduced by elements such as the LED module or the cabling.

This leakage current has to be taken into account in Class I installations so that the protective single-circuit trip switches can be appropriately sized.

In three-phase modules, leakage currents are compensated by balancing the distribution of the luminaires' connection between the three phases, while for single-phase networks, the maximum number of luminaires that can be connected to each switch has to be calculated.

NOTES:

- Typically a maximum of 35 luminaires can be connected in a 30mA residential single-circuit trip switch. As this maximum number can vary depending on the installation, ELT recommends that this is checked.
- The functional earth terminal may not be disconnected from the driver to reduce the leakage current value.

9. ELECTROMAGNETIC COMPATIBILITY

The control gear with eSMART technology manufactured by ELT is designed in accordance with the EN 55015 standard on Electromagnetic Compatibility.

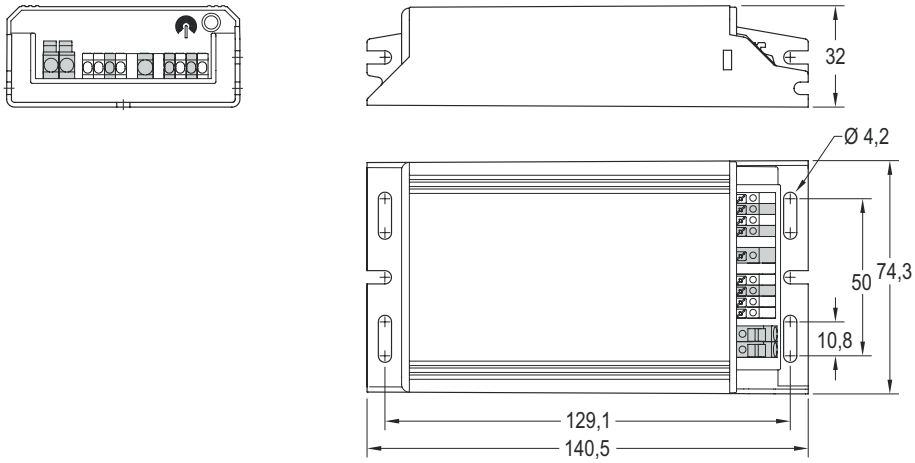
To guarantee compliance with this regulation, the following recommendations should be followed:

- Adjust the length of the cables between the LED module and the control gear to the minimum distance possible between connections.
- The connection wires to the LED module must run together, avoiding the creation of loops.
- The power cables, control cables and the connection to the LED module must be physically separated and never crossed.
- Running a cable over or sticking it to the control gear is not recommended.
- ELT recommends that the functional earth of every metallic component of the luminaire is connected to the protective earth in Class I luminaires, even though this connection is not designed to protect from electric shocks.

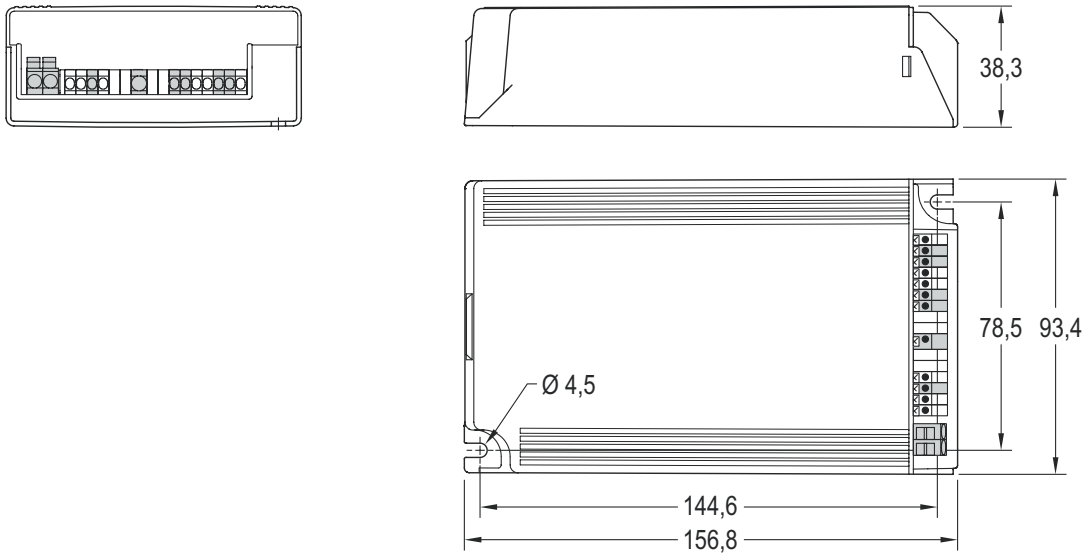
The eSMART control gear is of a “build-to-use” type. This means that the tests corresponding to standard EN 55015 have taken place on a benchmark luminaire using the driver, the LED module and the dissipater fixed to a metal mounting plate with a 20-cm long connecting cable between them. Respecting this benchmark assembly, the above-described recommendations and the indications contained in standard EN 55015, ELT guarantees test compliance.

10. MECHANICAL FEATURES

iLC PRO -XR format



iLC PRO -XT format



11. DRIVER CONFIGURATION

Thanks to the interface and configuration software, it is possible to make the most of the full flexibility and potential offered by ELT drivers equipped with eSMART technology, achieving solutions that perfectly adapt to the numerous and varied lighting applications that can be found.

11.1. iSOFT

iSOFT is the programming software that enables easy and intuitive configuration of the eSMART technology control gear, facilitating the creation of templates to configure functionalities and the required operating mode that best adapts to your application.

The iSOFT tool and its user guide, including a step-by-step explanation of every detail to install, use and configure the drivers, is available to be downloaded for free via the following link: **www.elt.es/en/download-isoft-software**

11.2. iProgrammer

Together with iSOFT software, iProgrammer is the communication interface required to configure any driver with eSMART technology.

Up to four drivers can be configured with no need for an external power supply. For more information, please follow this link **www.elt.es/en/iprogrammer**

11.3. Quick start guide

Download and install the iSOFT programming software.

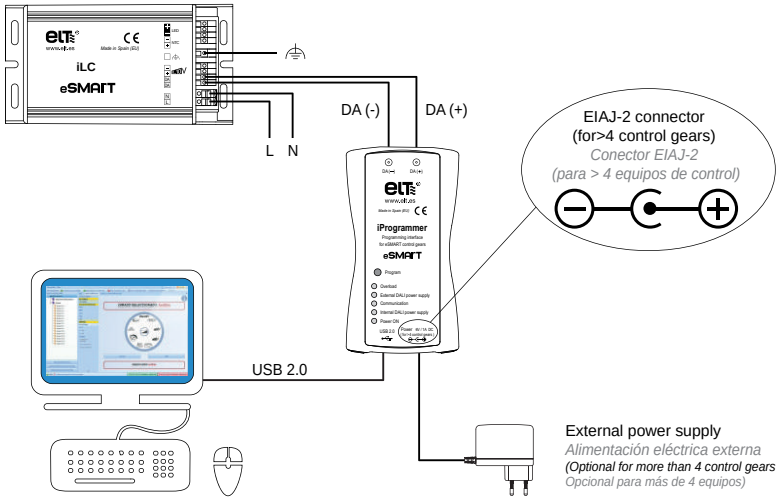
Activate and configure the features and dimming modes.

Download the selected configuration via the iSOFT programming interface.

Your driver is ready to use.

Programming the iLC drivers is a simple process. All you have to do is download and install the iSOFT programming software into your computer, select the required parameters and dimming modes for your application and then send the configuration to the driver following the connection layout illustrated below. Once the desired configuration has been sent, the driver is ready to use.

NOTE:
As the connection layout illustrates, the driver has to be connected to the power grid.



WARNING: The iProgrammer programming interface connection to the iLC control gear must take place via the DALI terminals marked "DA". The connection of the iProgrammer programming interface to other device terminals runs the risk of breakdown.

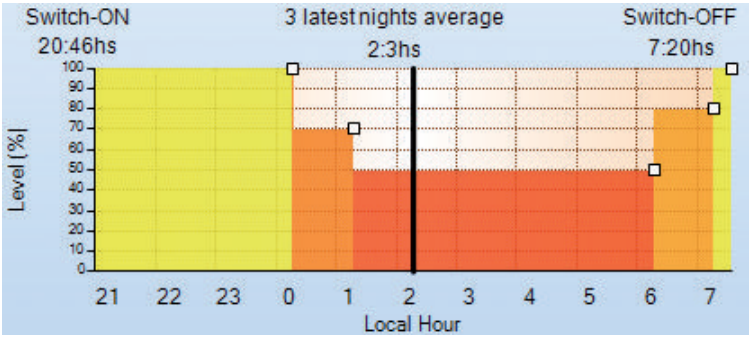
11.4. Factory default configuration

Functionalities	
Adjustable Output Current (AOC)	**700 mA**
LED Module Thermal Protection	Deactivated
Constant Lumen Output (CLO)	Deactivated
Module End of Life Alarm (EOL)	Deactivated
Programmable Start-Up (PST)	Deactivated
Parameter monitoring	**Always activated**

Operating modes	
ON/OFF	Deactivated
DALI	Deactivated
1-10V	Deactivated
0-10V	Deactivated
ActiDIM	**Activated**
Tourist ActiDIM	Deactivated
Parking mode (Corridor mode)	Deactivated
ActiDIM with Parking mode (Corridor mode)	Deactivated
LineSwitch	Deactivated
MainsDIM	Deactivated

ActiDIM mode default parameters

Time periods	Module power
Power-on	100%
2 hours before the middle of the night	70%
1 hour before the middle of the night	50%
4 hours after the middle of the night	80%
5 hours after the middle of the night	100%
Hour change	Activated



12. MARKINGS AND INDICATIONS

eSMART	Indicates devices equipped with eSMART technology.
STELARIA™	Indicates drivers compatible with the STELARIA™ remote street lighting management system.
CE	Marking that confirms product compliance with European directives.
01	Certification mark conferred by an official organism that accredits compliance with international safety and operating standards.
	Class II indicator. Device protected against electric shocks by a basic insulation and by an additional or reinforced insulation. No protective earth measures are incorporated however it may include a functional earth connection.
	Independent auxiliary apparatus that can be assembled on a stand-alone basis to the outside of a lighting fixture with no additional casing.
	Lamp control gear with double or reinforced insulation between the primary and secondary circuits, resistant to short circuits.
(1)	Lamp control gear with double or reinforced insulation between the primary and secondary circuits, resistant to short circuits and with Safety Extra-Low Voltage (SELV).
SELV (1)	Device with Safety Extra-Low Voltage (SELV).
100	Device with over-temperature protection. The number indicated inside the triangle shows the maximum temperature at any point of the surface of the casing in the event of driver failure.
DALI	Indicates conformity of the drivers with the IEC 62386 standard referring to the Digital Addressable Lighting Interface (DALI).
0...10V	Marking for drivers programmable by means of an analogue signal ranging from 0V to 10V that can enter into standby mode.
1...10V	Marking for drivers programmable by means of an analogue signal ranging from 0V to 10V that cannot enter into standby mode.
ORC <5%	Percentage of output ripple current, given as ±% over the nominal rms value.
	Device that incorporates protection against shock waves and power surges.
W Vrms	Marking for drivers programmable via mains grid voltage variation.
ActiDIM	Indicates drivers that incorporate stand-alone and dynamic dimming that adapts to night hours.
Corridor	Indicates systems that regulate the light level by means of presence detectors.
Corridor	Marking for stand-alone dimming combined with presence detectors.

(1) Models with a maximum output voltage lower than 120V

13. APPLICABLE STANDARDS

The drivers manufactured by ELT with eSMART technology, ENEC tested and certified, have been designed in accordance with the following international standards:

EN 61347-1	Lamp control gear. Part 1: General and safety requirements.
EN 61347-2-13	Lamp control gear. Part 2-13: Particular requirements for DC or AC supplied electronic control devices for LED modules.
EN 62384	DC or AC supplied electronic control devices for LED modules. Operational requirements.
EN 62493	Assessment of lighting equipment related to human exposure to electromagnetic fields.
EN 61000-3-2	Electromagnetic compatibility (EMC). Part 3-2: Limits. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase).
EN 61000-3-3	Electromagnetic compatibility (EMC). Part 3-3: Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems for equipment with rated current ≤ 16 A per phase and not subject to conditional connection.
EN 55015	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar.
EN 61547	Equipment for general lighting purposes. EMC immunity requirements.
EN 62386-101	Digital addressable lighting interface. Part 101: General requirements. System components.
EN 62386-102	Digital addressable lighting interface. Part 102: General requirements. Control gear.
EN 62386-207	Digital addressable lighting interface. Part 207: Particular requirements for control gear. LED modules (device type 6).

NOTE:
To view editions of the abovementioned standards, under which the certifications have been issued, please contact us by email at **elt@elt.es**, or by telephone on 976 573 660 or via our sales network.

14. PRODUCT WARRANTY

The drivers with eSMART technology are manufactured under the most demanding quality criteria, based on the ISO-9001 and ISO-14001 management standards, among others. This ensures a high level of durability, accompanied by a 5-year warranty for every product in this range.

Warranty conditions:

- The warranty period starts as from the date of delivery of the product.
- The warranty covers the replacement of the product and its corresponding labour costs. ELT accepts no liability for any other indirect costs that may arise. (As a reference to establish the replacement cost, please refer to the indications in the following document: "Application and maintenance recommendation for the use of electronic ballasts in view of the directive 99/44/EC" from CELMA which establishes that: "It is understood that professionally installed ballasts and lighting are replaceable within a maximum of 10 minutes").
- ELT reserves the right to request the return of the affected product to its premises in Zaragoza (Spain) to verify and subsequently validate the warranty claim.
- The warranty exclusively covers material defects and manufacturing faults in the components made and supplied by ELT.

The application of the warranty is subject to compliance with the following paragraphs:

- Operation of the lighting system in line with current IEC and/or EN international standards and the particular specifications provided by ELT in this user guide.
- Correct usage, handling and storage of the product to guarantee the absence of third party damage.

This warranty excludes claims under which ELT is not liable for defects or faults and, specifically, those **which fall within any of the following cases**:

- Incorrect handling, abusive use or any type of failure attributable to the customer or a third party, particularly in the case of non-compliance with the installation and usage conditions as defined by ELT contained in our catalogues, product sheets and technical documentation.
- Faults or fluctuations in the power supply.
- Anomalous operating conditions.
- Force majeure, such as: fire, flood, acts of war, violence or vandalism or similar situations.
- Faults in any accessory or other component (even in the event they were manufactured or supplied by ELT) that do not form part of the components covered by this warranty.
- Attempts to change or maintain the component by any individual other than an authorised installer.
- Where the component's batch number is damaged, changed or deleted.

The statutory warranty rights applicable to ELT's products do not vary as a result of this warranty and continue to have independent validity.

ELT reserves the right to take the final decision regarding any claim under the warranty and undertakes to quickly, fully, reliably and honestly process any claim submitted.

ELT reserves the right to modify these terms and conditions, without prior notice.

15. DISCLAIMER

This user guide for products with eSMART technology cancels and replaces all previous versions.

ELT reserves the right, without prior notice, to make changes to the data and information contained in this user guide, to the features of the product itself to which the guide refers and/or to cease manufacturing and/or commercialising the said product. ELT accepts no liability for any damage arising from the use of this guide or the use of the product to which it refers, beyond that explicitly established in the contract.

ELT has taken the utmost care in the drafting of this user guide and the information and data contained herein has been revised with all due diligence. Nevertheless, the appearance of editorial errors may not be ruled out, in respect of which ELT shall in no event be held liable. The reader is kindly requested to notify ELT of any error identified in this user guide.

ELT has provided all the information and data contained in this user guide to the best of its knowledge and understanding, however this information and data shall in no event constitute a guarantee, beyond that established by law. ELT expressly disclaims any commitment or liability based on the data and information contained in the user guide and the individuals responsible for the end product may not consider themselves released from the requirement to undertake their own tests and verifications.

The recommendations included in the user guide are based on the experience of ELT, but this does not signify that they are the best-known technical or commercial options. ELT accepts no claim based on any damage arising from the application of the above recommendations.

The data contained in this user guide that refers to technical features and product testing is for information purposes only and is not considered to be an official certification that supports the release of the end product into which the product the object of this guide is to be assembled. The manufacturer of the end product is responsible for testing the product in an accredited laboratory with a view to demonstrating compliance with the legal standards required by the end product in its place of installation, as well as the necessary requirements for every marking displayed on the end product (such as CE, ENEC, etc).

The product the object of this user guide is classified as “build-to-use” type control gear and as such, the data and features indicated in this guide may be affected by the end product into which it is assembled. ELT accepts no liability for damage arising from the adverse effects that the configuration of the end product may cause to the data and features of the product mentioned in this user guide.

ELT accepts no liability for possible unforeseen and adverse effects that may occur because of the interaction of the product the object of this user guide with any other product that forms part of the assembly of the end product, whether manufactured or not by ELT.

ELT kindly requests the user of this guide to ensure they are using the most up-to-date documentation and review its content when placing orders or using the product covered by this guide. The most recent approved version of our product guides can be found on the ELT website **www.elt.es/en**.

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