The Concept

# FL300

## *The* LED fixture for the horticultural industry

SENMATIC
DGT

The FL300 LED top-light is a 550 watt fixture emitting light in the photosynthetic active region of the visible light spectrum. The spectrums can be designed for individual crops in combination with LCC 4 climate control systems. This makes it a natural replacement to the conventional HPS systems used today.

Our solutions suit most modern production greenhouses in the world and are designed to withstand the harsh environment of a glass house and working year after year. The minimalistic design means easy installation using standard connection technology, and with a minimal shadow footprint, the FL300 is able to produce good quality plants all year long.

FL300 is CE marked according to standards in horticultural lighting and ROHS compliant.

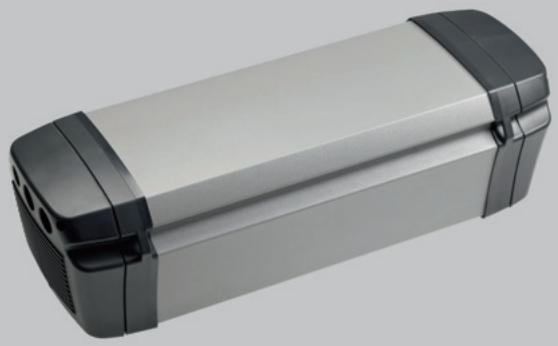
More information is to be found on the website of www.senmatic.com and www.fionialighting.com.

Fionia Lighting

Fionia Lighting has researched and tested the application of LEDs for horticultural practice with success since 2005 and is one of the pioneers in this field. Research fields ranging from basic photosynthesis to advanced light guide control enable Fionia Lighting to combine many advanced elements into a new state of the art air-cooled LED top-light fixture. The Fionia Lighting products are currently used with some of the world's largest greenhouse growers, and are also used in research facilities, universities and plant schools.

The combination of active cooling and lens system for the horticultural industry is patented by the University of Southern Denmark. This patent is now owned by Fionia Lighting.

| Parameter | |
|---|---|
| Power input | 230 V AC / 50-60 Hz |
| Power usage | 100-650 watt |
| | (adjustable via controller) |
| Light output | 2,4 µmo/watt |
| Weight | 10 kg |
| Dimension | 550 x 230 x 160 mm |
| Operating temperature | 0-40 °C |
| Degree of protection | IP 54 |
| Light intensity decay | At least 50,000 hours at L85B10 |
| Coverage | 6-12 m² |
| | (depending on light intensity) |



*FL300 fixtures covering more than 1.500 m² in production unit 11 at PKM.*

# FL300 is the first working top-light LED

The greenhouse of PKM is one of the largest flower growers in Europe with a total area of 260.000 m², and is well known for innovation in developing new plants and being a pioneer in new technology. During four successive growth seasons PKM has tested the Fionia Lighting LED systems and has been involved in developing light recipes and perfecting the FL300.

During the growth season 2011/2012 more than 100.000 Campanula flowers were grown under LED lights from Fionia Lighting, and the results demonstrate conclusively the advantages.

- 53% electricity savings compared to conventional HPS system
- 43% electricity savings compared to new 1.000 watt HPS system
- Result: Same plant quality and same sales price as crops produced under 1.000 watt HPS

When growers come to visit production unit 11 at PKM, they realize a few things regarding the technology of Fionia Lighting.

The first thing they notice is the installation. Setting up FL300 is as easy as HPS systems, and no special arrangements are necessary. The special designed optical profile ensures a very homogenous light intensity no matter where you are in the greenhouse.

The second realization is the integration. Apart from the minimalistic installation, the LED system is now as integrated in the climate control system of Senmatic DGT as opening the windows or closing the screens. Everything is controlled centrally or with the tablet PC directly in the greenhouse.

The third thing is the plant quality. Despite the low electricity consumption the plants are growing very well in the “new light” and are the same or even on some parameters better than the HPS quality.

*Cell 3 and 4 at the Kold College School for growers. The climate and the LED light are controlled by the LCC 4 climate computer of Senmatic.*


*The new touch screen LCC 4 LED control unit is equipped with the latest knowledge in intelligent climate control for modern production greenhouses.*

# LED light in total control

Kold College education facility has just invested in the most advanced technology. It is one of the biggest and best equipped schools for upcoming growers in the world. Fionia Lighting has equipped cell 3 with 48 FL300 LED fixtures for direct comparison with all new HPS 600 watt fixtures in cell 4. This is a very unique testing facility that enables development of light recipes for all sorts of crop.

The greenhouse was operational the 1st of February 2012 so preliminary data is available. Initial measurements on the electrical consumption and the light intensity showed interesting results in favour of the LED lighting.

| | FL300 | 600 watt HPS |
|---|---|---|
| Number of lamps | 48 | 48 |
| Light intensity | 125 µmol/m²*s | 125 µmol/m²*s |
| Lamp consumption | 367 watt | 640 watt |

**LCC 4 LED control**

The FL300 fixture is equipped with the industrial standard communication bus RS-485. This enables the grower to control the LED light and to develop different light recipes for his crops.

The FL300 LED lamps, just like HPS lamps, can be sold as stand alone units. However to get the full benefit of your FL300 lamps, the use of a LED control system is highly recommended. Our LCC4 LED system is the first commercially available LED control system, which gives the grower the following advantages:

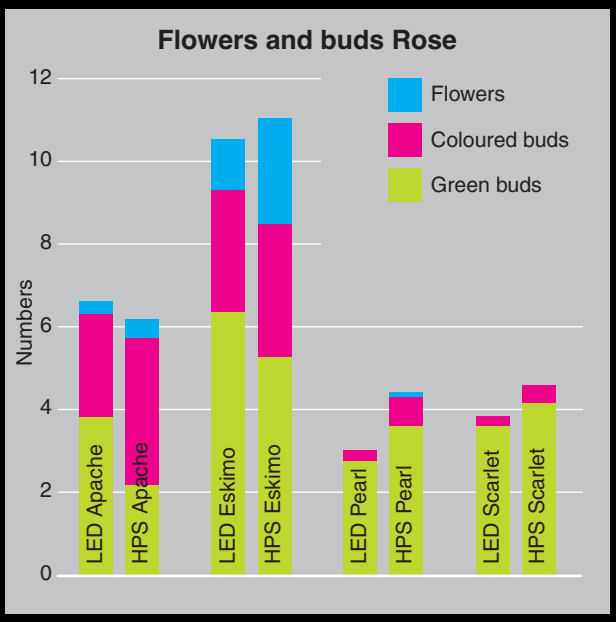
- Controlling the light intensity
- Controlling the Red/Blue ratio
- Controlling the fixtures based on light-sum or light intensity
- Divide your LED installation into six different groups for total control

The alliance between Fionia Lighting and Senmatic offers the grower state of the art knowledge in light and climate control. The FL300 will, regardless of your current climate control provider, be sold with the knowledge necessary for making LED light a good solution for you and your crops.

If you have an alternative climate computer provider without LED controller the FL300 can be purchased together with the LCC 4 LED controller. That way you still have full control of your LED installation.

More information regarding this is to be found on the website www.senmatic.com.

*The Apache result. LED (left) and HPS (right). Notice the compact quality of the LED rose and the elongated HPS rose.*




*Four different rose cultures responding to LED and HPS treatment.*

# FL300 is the first top-light LED fixture with documented results

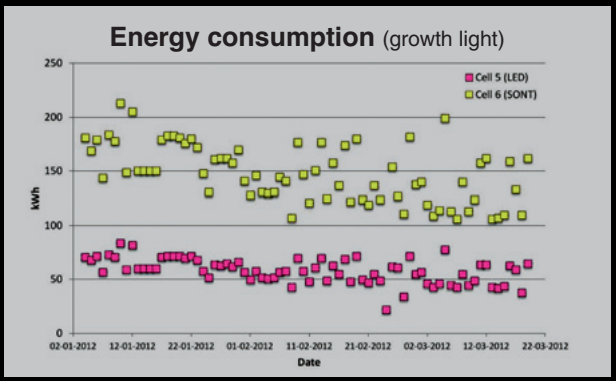
Many LED companies makes various claims promising huge electrical savings and plants growing at twice the normal speed. LED fixtures are not a quick fix, and cannot be installed without knowledge about plant morphology, production routines and so on including climate control.

Aarhus University has independently investigated the FL300 fixture in regards to plant quality and energy consumption. One 80 m² cell was equipped with FL300 and the other 80 m² was equipped with 600 watt HPS lamps.

The simultaneous experiment was conducted with every parameter identical except for one. In order to have almost the same production time in the two different cells, optimizing the heat inputs was necessary.

In order to replicate the performance of standard lamps, different heating protocols need to be established for LED fixtures.

This knowledge was obtained in the Aarhus University Studies and is now a part of the complete knowledge package when purchasing FL300.




*Electricity measurements on a daily basis from the experiment. On average a 60% electrical saving when growing roses.*

Aarhus University has tested many crops, and one of the more challenging flowers the Rose is visualized here.

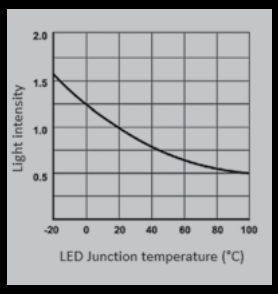
More information regarding this is to be found on the website www.fionialighting.com.

# Mythbusters

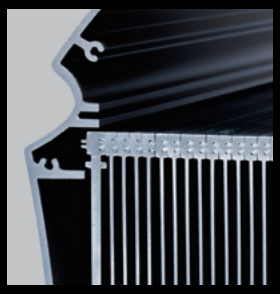
MYTH:

## ”A top-light LED fixture can be passively cooled!”

BUSTED: The life span of an LED depends on the semi-conductor material used as well as the current/heat relationship. Excessive high temperatures dramatically reduce the length of the LED's life. Fionia Lighting's patented cooling solution uses the best quality fan available with a lifetime well above 100.000 hours. This, combined with a unique aluminum heat sink profile, enables us to cool the LEDs below 45 °C where other passively cooled fixtures have LED temperatures above 100 °C.




*Intensity as a function of LED temperature.*



*Patented cooling solution of FL300.*

MYTH:

## ”LED fixtures are too expensive”

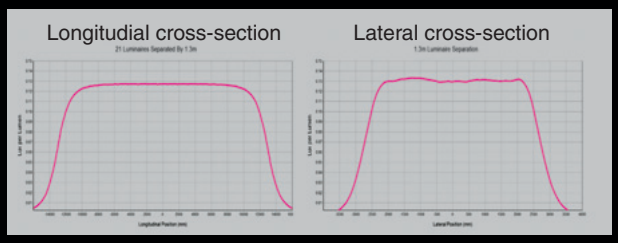
BUSTED: LED fixtures are higher priced than conventional lighting used for greenhouses, but an analysis of total cost of ownership shows a different story. With the electrical savings demonstrated, the return on investments is positive already after few years, and thereafter you will make money year after year on your Fionia Lighting LED solution. Furthermore there are added benefits such as increased and stable plant quality, reduction of chemicals, fewer bulb changes etc.

The Investment in FL300 is a long term investment in your production facility and a profitable future.

MYTH:

## ”You can use top-light fixtures without optical systems”

BUSTED: An advanced optical system is critical to providing homogenous plant production using LED's. Along the central axis the LED emits 100 percent of its relative luminous intensity and will lose intensity the farther you move away from the central axis.




*Distribution profile FL300 LED fixtures.*

The design of a good optical system must minimize the loss within the fixture as well as maximize targeting efficiency of the desired illumination area. Therefore the FL300 is equipped with an optical lens system with a distribution that ensures a homogenous lighting profile.

*FL300 fixtures growing orchids. Notice the sharp distribution profile at the back wall.*

Please contact Senmatic to hear more about the LED technology.

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