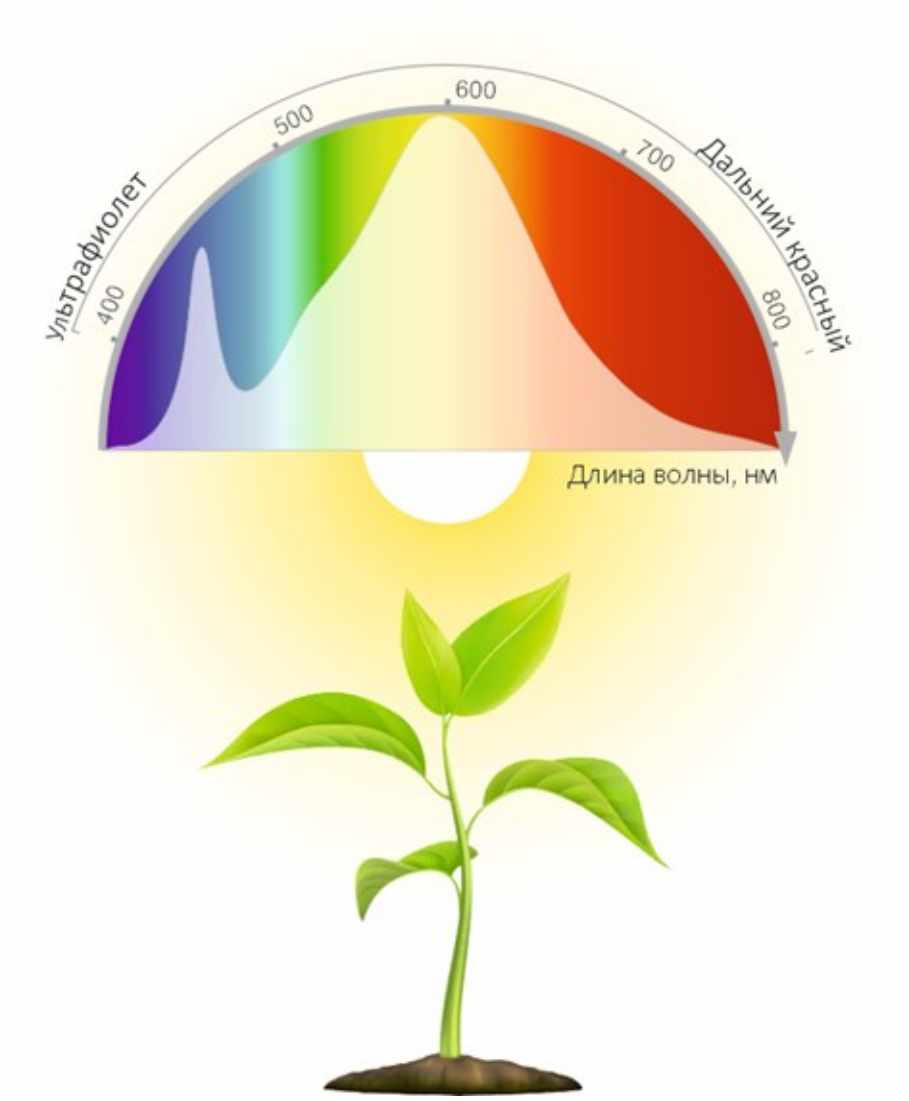
## Artificial plant lighting on multi-tier systems

# Modules LED FARM

## DATA SHEET



# Application

LED FARM modules are designed to create energy-efficient artificial lighting for plants when growing them on multi-tiered systems (shelvings) in protected ground cultivation facilities: "urban" (vertical) farms, phytotrons, greenhouses.

6,5

# Design

**Housing**
Made from high quality aluminum.

**Safety glass**
Manufactured from UV stabilized optical polycarbonate.

**LEDs**
High-efficiency energy-saving LEDs manufactured by Seoul Semiconductor (South Korea)

**Side covers**
Made from durable polymer material.

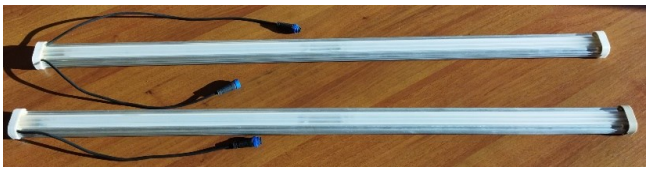
**Fastening**
Modules are supplied with fastening elements: hardware / corners / brackets.

LED FARM modules have two design versions that differ in the input (output) of the supply wire. In the module designation:

X = 1 - the module has only an input wire;
X = 2 - the module has an input and output wire.

**LED FARM 40.0.X** **LED FARM 80.0.X**

**LED FARM 40.1.X** **LED FARM 80.1.X**

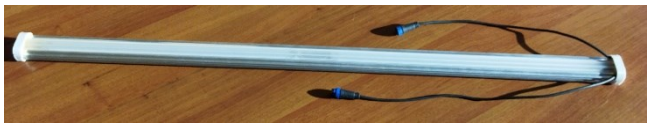


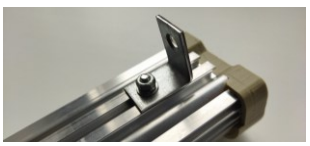
**LED FARM 40.0.1 / LED FARM 80.0.1**

**LED FARM 40.1.1 / LED FARM 80.1.1**

**LED FARM 40.0.2 / LED FARM 80.0.2**

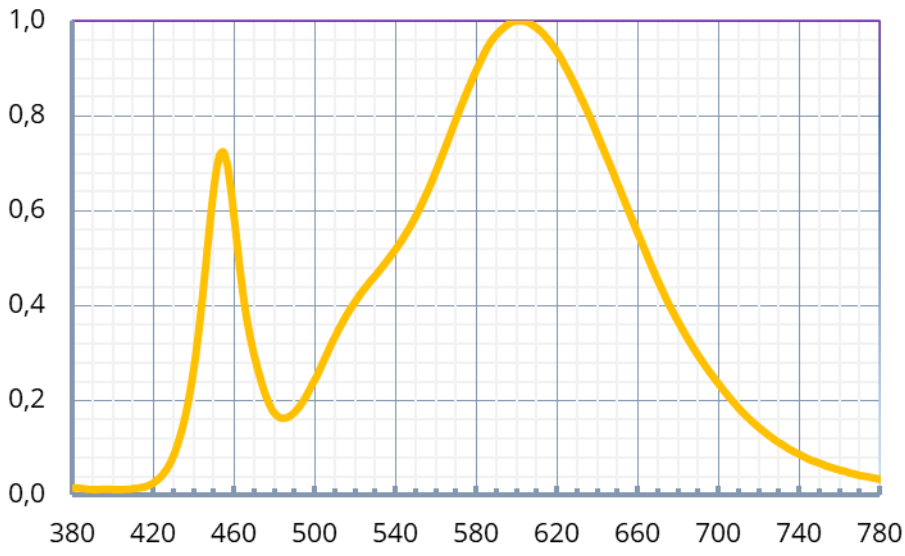
**LED FARM 40.1.2 / LED FARM 80.1.2**





# Technical parameters

| Parameter name | Designation | | | |
|---|---|---|---|---|
| | LED FARM 40.0.X | LED FARM 80.0.X | LED FARM 40.1.X | LED FARM 80.1.X |
| Input current direct (DC), A | 1,4 | 1,4 | 1,4 | 1,4 |
| Input voltage, V | 28 | 56 | 28 | 56 |
| Power consumption, W | 39 | 78 | 39 | 78 |
| Radiation flux, W | 19 | 38 | 19 | 38 |
| Photon flux, μmol/s | 92 | 184 | 92 | 184 |
| Luminous flux, lm | 6250 | 12500 | 6250 | 12500 |
| Distribution class | П | П | П | П |
| Type of luminous intensity curve | Д | Д | специальная | специальная |
| Energy safety class | A+ | A+ | A+ | A+ |
| Degree safety | IP65 | IP65 | IP65 | IP65 |
| Operation temperature range, $^0$C | +1...+30 | +1...+30 | +1...+30 | +1...+30 |
| Weight, kg | 0,8 | 1,6 | 0,6 | 1,2 |
| Dimensions, mm | 585x134x33 | 1160x134x33 | 585x55x40 | 1160x55x40 |




The nominal service life of the modules is 10 years with reliability indicators $L_{90}F_{10} \geq 60000$ hours (GOST R 56230-2014, IEC/PAS 62717:2011).
Warranty period of operation - 36 month.

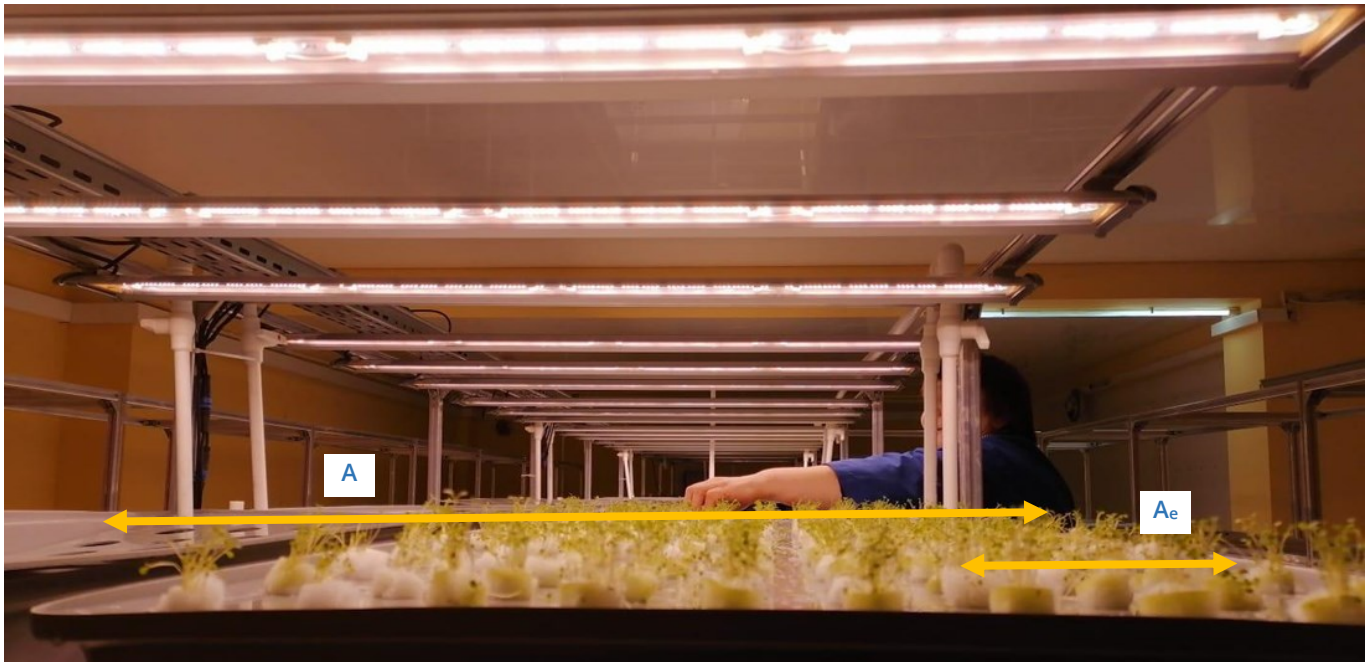
FLORA LED modules are a source of optical radiation in a wide range of wavelengths, including in the range of photosynthetic active radiation, ensuring the course of the whole variety of photobiological processes inherent in plant organisms.

# Installation

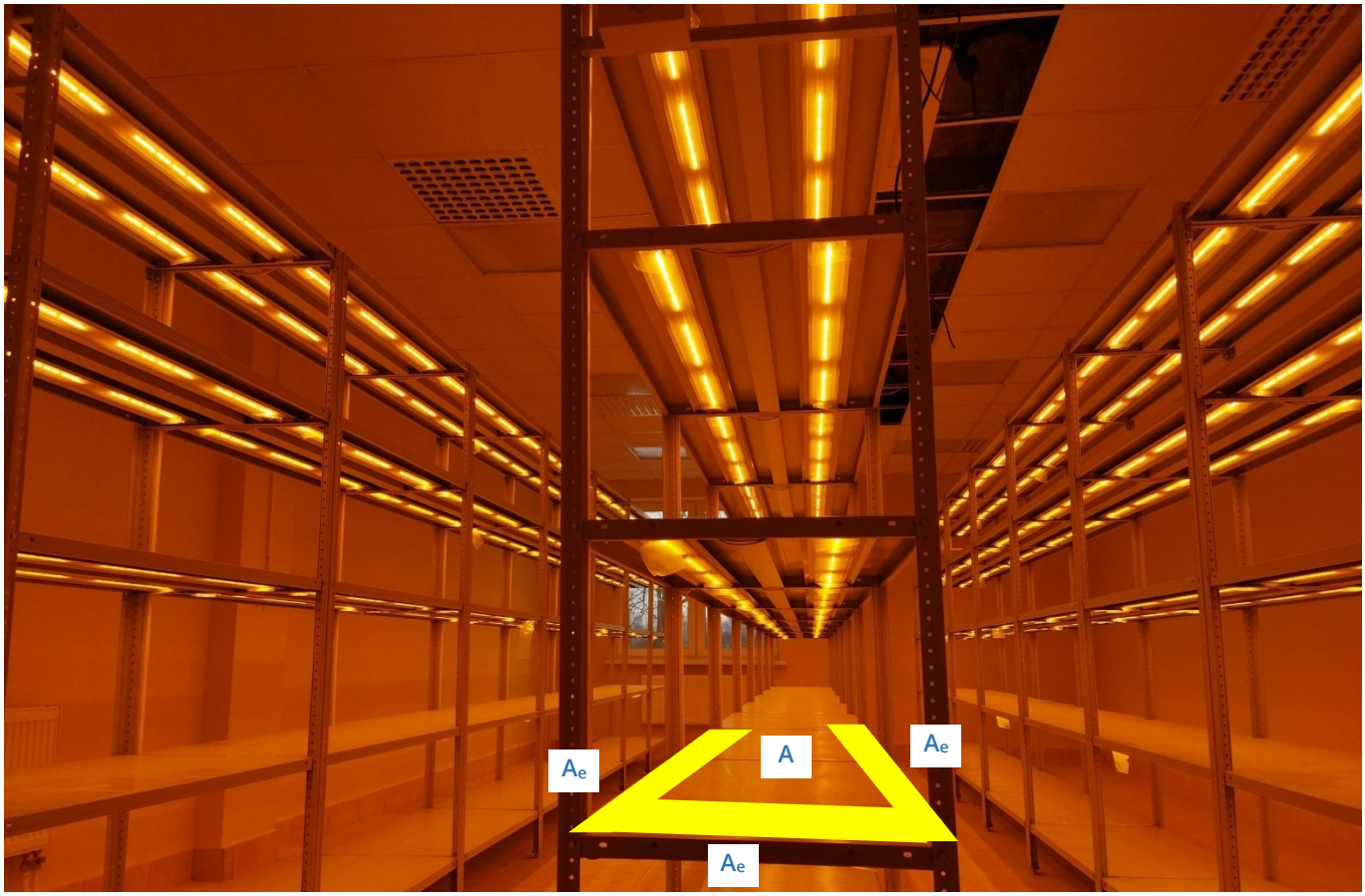
To increase the energy efficiency of rack-type phyto-installations, it is recommended to place the modules in the transverse direction of the rack system. With such a layout of luminaires, the light fluxes of individual luminaire overlap in the volume of agrophytocenosis. The minimum specific gravity of the edge area ($A_e$) in the total area of the cultivation zone (**A**) is achieved. This arrangement of modules is also more convenient for maintenance and repair of lighting equipment.

LED FARM modules are connected in series into an electrical circuit between themselves and connected to an external power supply network through an AC - DC power source (driver). It is recommended to use power supply type XLG-240-M-A or XLG-240-M-AB (if you need to implement control via an industrial controller using the 1-10 V protocol). An optimal electrical circuit is recommended, including: 1 pc power supply XLG-240-M-A (AB) and 6 modules LED FARM 40.X.X or 3 modules LED FARM 80.X.X modules.


**Transverse arrangement of modules**



**Longitudinal arrangement of modules**




Spacing (S) – the distance between adjacent modules.
It is recommended to install modules with a step
S = 60 cm (to obtain an irradiation level of 40 W/m$^2$ or
200 μmol/m$^2$ • s).

Mounting height (H) – distance from the protective glass of the module to the agrophytocenosis (the upper part of the plants.

It is recommended to install the modules at a distance from the tops of the plants:

LED FARM 40.**0**.X and LED FARM 80.**0**.X  H = 30 - 40 см
LED FARM 40.**1**.X and LED FARM 80.**1**.X  H = 10 - 15 см

# DLI recommendation

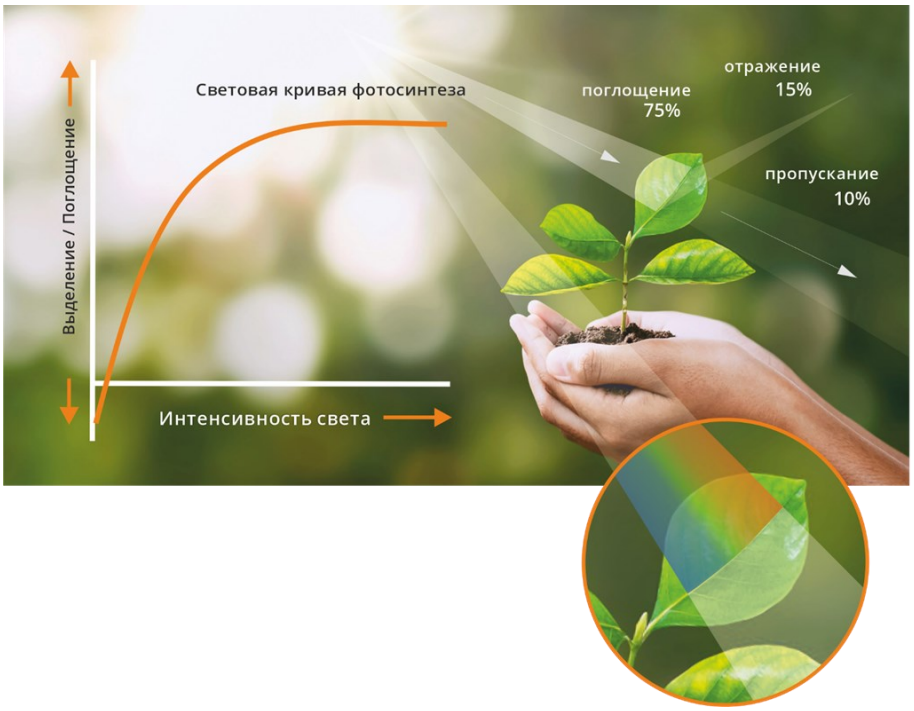
The intensity of photosynthesis strongly depends on the irradiance of the phytocenosis of photosynthetic active radiation (photosynthetic irradiance). This dependence is expressed by a logarithmic curve, called the light curve of photosynthesis.

There are three characteristic sections of the photosynthesis curve:

**01** Straight section up to irradiance level 100...150 W/m$^2$ or 500...750 µmol/m$^2$•s PAR (20000...30000 lx). In this area, the rate of photosynthesis increases in proportion to the increase in irradiance.

**02** Curvilinear section up to irradiance level 250...300 W/m$^2$ or 1250...1500 µmol/m$^2$•s PAR (50000...60000 lx). In this area, the rate of photosynthesis slows down, but continues to increase, although not in proportion to the increase in irradiance.

**03** Straight section. In this area, a further increase in irradiance does not cause a change in the rate of photosynthesis. The latter state is called the state of light saturation. In plants of the temperate zone, light saturation occurs at an irradiance of 100...200 W/m$^2$ or 500...1000 µmol/m$^2$•s PAR (20000...40000 lx).




Recommended levels of plant irradiation and daily dose of irradiation

| Plants | DLI (Daily Light Integral) | | PPFD | |
|---|---|---|---|---|
| | MJ/m$^2$ | mol/m$^2$ | W/m$^2$ | µmol/m$^2$ •s |
| Micropropagation of plants | 0,5 – 1,0 | 2,5 – 5,0 | 10 – 20 | 50 – 100 |
| Microgreens, green crops, seedlings | 1,0 – 2,0 | 5,0 – 10,0 | 20 – 40 | 100 – 200 |
| Berry crops | 2,0 – 4,0 | 10,0 – 20,0 | 40 – 80 | 200 – 400 |
| Vegetable crops (tomato, cucumber, pepper) | 4,0 – 8,0 | 20,0 – 40,0 | 80 – 120 | 400 – 600 |

The following optimal standardized irradiance in the greenhouse is recommended:
40 W/m$^2$ (180 – 200 µmol/m$^2$•s) PAR with a photoperiod of 14 hours when growing seedlings;
100 W/m$^2$ (450 – 500 µmol/m$^2$•s) PAR with a photoperiod of 16 hours when growing plants for production.

In this case, the optimal daily amount of irradiation (dose) for seedlings will be 560 W•h/m$^2$ (2.0 MJ/m$^2$•day or 9–10 mol/m$^2$•day), and for growing plants for production - 1600 W •h/m$^2$ (5.8 MJ/m$^2$•d or 26 - 29 mol/m$^2$•d).

Approximate solar radiation and total PAR under average cloud conditions at $60^0$ north latitudes

| Solar radiation for period | | Unit | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **I** | **II** | **III** | **IV** | **V** | **VI** | **VII** | **VIII** | **IX** | **X** | **XI** | **XII** |
| Month | Total | $MJ/m^2$ | 37 | 94 | 261 | 374 | 590 | 634 | 596 | 432 | 237 | 104 | 36 | 18 |
| | PAR | $MJ/m^2$ | 17 | 42 | 117 | 168 | 266 | 285 | 268 | 194 | 107 | 47 | 16 | 8 |
| | | $mol/m^2$ | 75 | 190 | 529 | 757 | 1195 | 1284 | 1207 | 875 | 480 | 211 | 73 | 36 |
| Day | Total | $MJ/m^2$ | 1,2 | 3,4 | 8,4 | 12,5 | 19,0 | 21,1 | 19,2 | 13,9 | 7,9 | 3,4 | 1,2 | 0,6 |
| | PAR | $MJ/m^2$ | 0,5 | 1,5 | 3,8 | 5,6 | 8,6 | 9,5 | 8,7 | 6,3 | 3,6 | 1,5 | 0,5 | 0,3 |
| | | $mol/m^2$ | 2 | 7 | 17 | 25 | 39 | 43 | 39 | 28 | 16 | 7 | 2 | 1 |

Approximate solar radiation and total PAR under average cloud conditions at $43^0$ north latitudes

| Solar radiation for period | | Unit | Месяц | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
| Month | Total | $MJ/m^2$ | 144 | 188 | 321 | 491 | 678 | 719 | 718 | 629 | 445 | 309 | 162 | 124 |
| | PAR | $MJ/m^2$ | 65 | 85 | 144 | 221 | 305 | 324 | 323 | 283 | 200 | 139 | 73 | 56 |
| | | $mol/m^2$ | 292 | 381 | 650 | 994 | 1373 | 1456 | 1454 | 1274 | 901 | 626 | 328 | 251 |
| Day | Total | $MJ/m^2$ | 4,6 | 6,7 | 10,4 | 16,4 | 21,9 | 24,0 | 23,2 | 20,3 | 14,8 | 10,0 | 5,4 | 4,0 |
| | PAR | $MJ/m^2$ | 2,1 | 3,0 | 4,7 | 7,4 | 9,8 | 10,8 | 10,4 | 9,1 | 6,7 | 4,5 | 2,4 | 1,8 |
| | | $mol/m^2$ | 9 | 14 | 21 | 33 | 44 | 48 | 47 | 41 | 30 | 20 | 11 | 8 |

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