

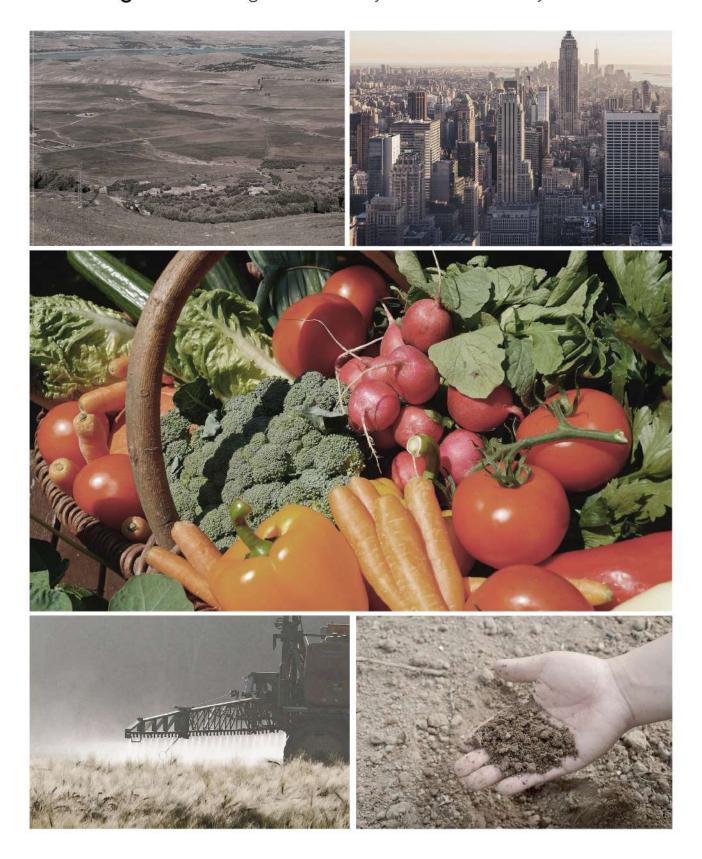
# SMART FARMING:

Horticulture Lighting



## Smart Farming Technologies:

## **Technologies:** Sowing Food Security in the 21st Century







With the demographic growth ever more noticeable in the urban environment, in the near future a decrase in the number of peaple and vacant lots will occur in rural areas. The consequence is obvious...it will not be possible to feed all these people and megacities using conventional agriculture in order to feed this growing population. we will need to double or even triple, our production output in the coming decades. Is this goal feasible or even reasonable. in our already challenged planet?



#### Main Reasons

World Population increased - over 83 thousand/year about 10 billion inhabitants in 2050:

Food Production increased - 60-70% more in agricultural production. In Particular vegetables and fruit (health awareness):

Business requirements - Increased shelf life Uniformization of shape and Size Appealing colors:

Pharmaceutical industry - Promotion of artificial cannabis growt for medicinal purposes:

Climate change and natural disasters - Comes in to play the issue of quality and food viability

Scarce natural resources - 80% of used land / 70% fresh water / +65% lost in evaporation / 30% of Fossil fuels used by the food sector

Transport - Economic impact / Environmental impact

Incorporation of chemical agents - Transgenics / Fertilizers / Coatings (resins that ensure maturation delay).









## Lighting for Horticulture

The way that the human eye perceives light is completely different to how plants see light. Plants perceive light as particles that they can absorb. These particles are also known as photons or quantum. Because of the difference in the way that plants perceive light, the particles are measured in umol/m2/s rather than in lux, which is a unit based on how the human eye sees light.

Selecting the best spectral power distribution is not a simple matter. When light affects the growth characteristics of a plant, it is known as phototropism. At its most basic, phototropism can cause a plant to grow towards or away from a light source, but additional growth changes are possible. The same is also true with spectrum. As noted earlier, a spectrum heavier in reds tends to make plants grow longer stems, and a spectrum heavier in blues encourages leaf growth. While these colors may seem obvious given the McCree Curve, other studies have shown that supplementing these colors with green light (up to a certain point) will enhance growth for some species, further supporting the need for multiple spectrums of light for optimal plant growth.

The sheer number of metrics that can be associated with visible light can get confusing, and with horticultural lighting this is no different. To reiterat an earlier point, lumens (and lux, candela, etc.) are all adjusted for the human eye response and, as such, are not an appropriate reference and should not be considered when evaluating a fixture for horticultural applications. The primary metrics for horticultural use are focused on the quantities of photons produced (typically measured in piccomoles, or 6.022x1017 photons per micromole) as these are what get absorbed by th plant. Though others can be explored, the most common metrics are listed below:

Photosynthetic Photon Flux (PPF) - This metric is the unweighted photon flow in micromoles per second, but not necessarily in any one direction. This would be somewhat analogous to lumens, as it is an overall quantity.

Photosynthetic Photon Flux Density (PPFD) - A density based metric that focuses on how many moles hit one square meter per second. This would be similar to a lux, where it is the quantity hitting a specific area.

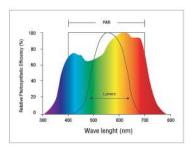
Daily Light Integral (DLI) – This metric involves the number of moles of photons that hit a surface over a 24 hour period.

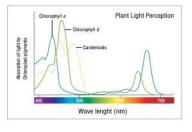
Additional metrics and definitions are being worked on by organizations such as the American Society of Agricultural and Biological Engineers (ASABE), as are the test methods which are used to acquire these measurements. One such potential metric expands the wavelength range beyond photosynthetically active radiation and could include the ranges in UV, far-red and infrared to which plants are also sensitive.











€ 75 50



To get the best out of a crop of plants, there may be a specific light formula that is appropriate, and that light formula may change over time depending on what the desired growth of the plant is and what stage of the plant lifecycle it is in.

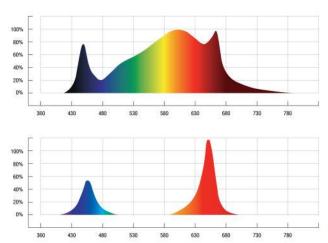




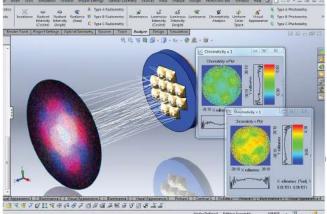
## Our products:

#### with cutting edge technology

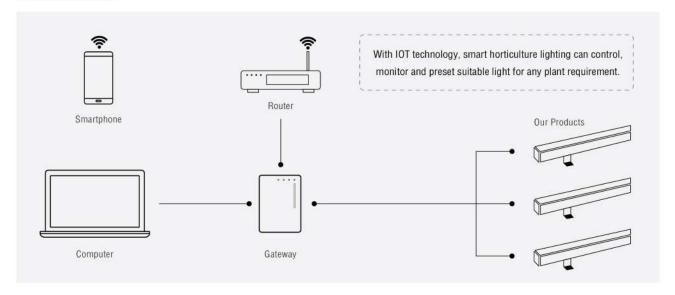
- Tailor made light spectrum for mediate developmental responses in seed germination, stem elongation, and flowering
- · Optical design to create sufficient and uniform PPFD
- · Fully control with smart system
- · Quality control by L&E solid state factory and laboratory



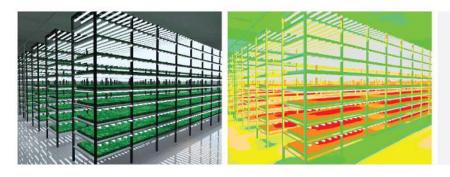




#### **Smart Solution**



#### PPFD / DLI Calculation



Our expert could provide PPFD Calculatio for your farm to confirm uniform and sufficient light.





## Type of Horticulture Lighting







## L&E Spectrum

L&E's wide range of spectrum offer the proper light for plants with high energy efficiency. In addition to photosynthesis, our spectrum give valuable information to plants about their environment, allowing control of plant morphology and physiological traits.



Strong vegetative and generative growth

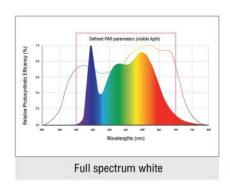
Strong vegetative growth

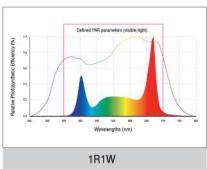
Full spectrum white

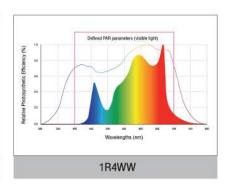
Research and Biotech

Essential Series	HLBR30RW	HLPAR38RW	HLBT1200RW	HLT81200RW	HLT81200RW-IP	MG-I	MG-F
Residential	•	0	•	0	0	0	0
Vertical Farming			•	0	•		
Tissue Culture				•			

Proficient Series	HLLNH01200RW	HLVP240S	HLCL-06	HLCL650W	HLHBL731PW
Vertical Farming	•				
Greenhouses		0	0	•	•
Cannabis	0	0	•	•	•













#### **Essential Series**

#### Description

- Essential spectrum for general plant with aesthetic color appearance
- Precise light distribution to reach high PPFD for vertical farming
- · Long lifetime with less energy consumption
- · Support and advice for your requirements



Housing: Aluminum and high quality plastic

Control Gear: build-in driver

Power: 18W

Input Voltage: 230VAC±10% /50Hz

Power Factor: >0.9

THDi: <15%

Luminous : Flux >2400 lumen Color : Horticulture White (1R4W)

Beam Angle: 120 degree

Linkable batten: maximum 8 set

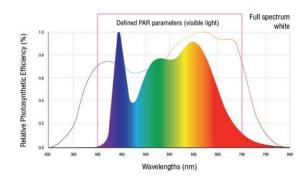
IP Rating: IP20

LED Lifetime: 50000 hours

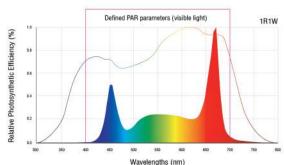
Warranty: 2 year

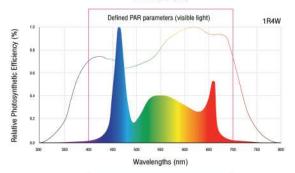
#### Dimension

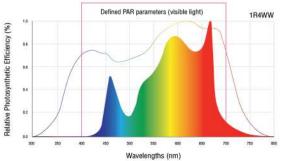












Product	Power(W)	Color	Voltage(V)	PPFD @ 30cm	R/B ratio	Application
HLBT1200W3065		W3000+6500K			1.6	
HLBT12001R1W65	18W	1R1W6500K 230VAC 1R4W6500K	23U/AC	50 <b>µ</b> mol/m²/S	2.7	Home planting,
HLBT12001R4W65	1844		230VA0		1.5	Vertical Farming
HLBT12001R4W30		1R4W3000K			4.6	





#### **Essential Series**

#### Description

- Essential spectrum for general plant with aesthetic color appearance
- Precise light distribution to reach high PPFD for vertical farming
- · Long lifetime with less energy consumption
- · Support and advice for your requirements

#### Specification

Housing: High quality plastic

Lamp Holder: G13

Control Gear: Build-in driver

Power: 18W

Input Voltage: 230VAC ± 10% / 50Hz

Power Factor: >0.9

THDi: <15%

Luminous Flux: 2200-2500 lumen

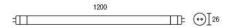
Color : Horticulture White Beam Angle : 120 degree

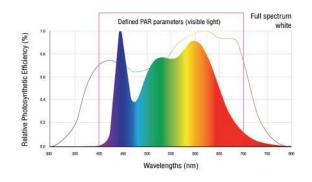
IP Rating: IP20

LED Lifetime: 50000 hours

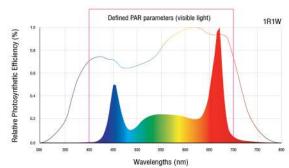
Warranty: 2 year

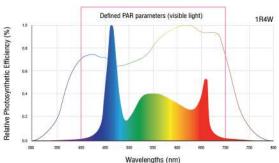
#### Dimension

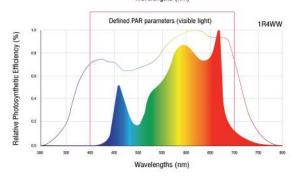












Product	Power(W)	Color	Voltage(V)	PPFD @ 30cm	R/B ratio	Application
HLT81200W3065		W3000+6500K			1.6	
HLT812001R1W65	18W	1R1W6500K	230VAC	50µmol/m²/S	2.7	Vertical Farming,
HLT812001R4W65	1011	1R4W6500K	250 VAO	30 <b>µ</b> 11101/111/3	1.5	Vertical Garden
HLT812001R4W30		1R4W3000K			4.6	





#### **Essential Series**

#### Description

- Essential spectrum for general plant with aesthetic color appearance
- Precise light distribution to reach high PPFD for vertical farming
- · Long lifetime with less energy consumption
- · Water and dust resistance.
- · Support and advice for your requirements

#### Specification

Housing: High quality plastic Control Gear: Build-in driver

Power: 18W

Input Voltage: 230VAC ± 10% / 50Hz

Power Factor: >0.9

THDi: <15%

Luminous Flux: 2200-2500 lumen

Color : Horticulture White Beam Angle : 120 degree

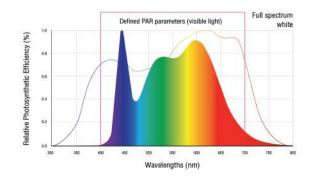
IP Rating: IP65

LED Lifetime: 50000 hours

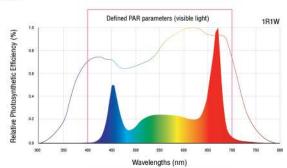
Warranty: 2 year

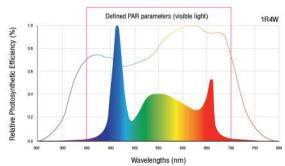
#### Dimension

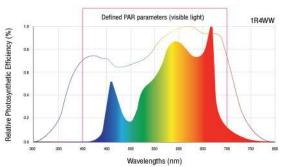












Product	Power(W)	Color	Voltage(V)	PPFD @ 30cm	R/B ratio	Application
HLT8IP1200W3065		W3000+6500K			1.6	
HLT8IP12001R1W65	18W	1R1W6500K	230VAC	50µmol/m²/S	2.7	Vertical Farming,
HLT8IP12001R4W65	10 00	1R4W6500K	W6500K	30 <b>μ</b> ποι/π /3	1.5	Vertical Garden
HLT8IP12001R4W30		1R4W3000K			4.6	





#### **Essential Series**

#### Description

- HLBR30RW LED Grow lamp with energy efficient and spectral optimized for maximize plant growth.
- Suitable for human visual system and excellent color saturation.
- · Long lifetime with less energy consumption
- · Support and advice for your requirements

#### Specification

Housing: High quality plastic

Lamp Holder: E27

Power: 12W

Input Voltage: 100-240VAC / 50Hz

PPFD: 50µmol/m²/s@ 30cm

R/B ratio: 2.7

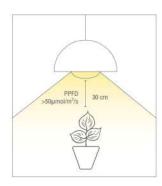
Color : Horticulture White Beam Angle : 100 degree

IP Rating: IP44

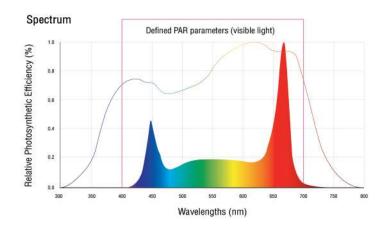
LED Lifetime: 25000 hours

Warranty: 1 year









Product	Power(W)	Color	Voltage(V)	Application
HLBR30RW	12W	Horticulture White	100-240VAC	Home planting, Vertical Farming



#### **Essential Series**

#### Description

- HLPAR38RW LED Grow lamp with energy efficient and spectral optimized for maximize plant growth.
- Suitable for human visual system and excellent color saturation.
- · Long lifetime with less energy consumption.
- · Support and advice for your requirements.

#### Specification

Housing: High quality plastic

Lamp Holder: E27

Power: 15W

Input Voltage: 100-240VAC / 50Hz

PPFD: 110µmol/m²/s@ 30cm

R/B ratio: 2.7

Color : Horticulture White Beam Angle : 90 degree

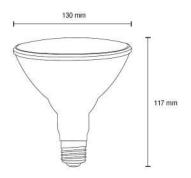
IP Rating: IP44

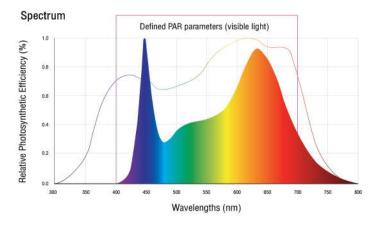
LED Lifetime: 25000 hours

Warranty: 1 year









Product	Power(W)	Color	Voltage(V)	Application
HLPAR38RW	15W	Horticulture White	100-240VAC	Home planting, Vertical Farming





#### Mini Garden Series

#### Description

- L&E Mini-garden horticulture lighting is perfect for home and office planting to get more green space.
- · Simple design makes it compatible with any space.
- Auto on-off time 16/18 hours build-in driver.
- · Adjustable height to suit your plant.



Housing: High quality plastic and steel

Power: 20W

Input Voltage: 220VAC / 50Hz

PPFD: 200µmol/m²/s@ 20cm

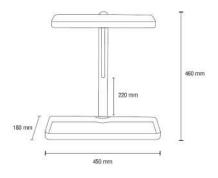
R/B ratio: 4.2

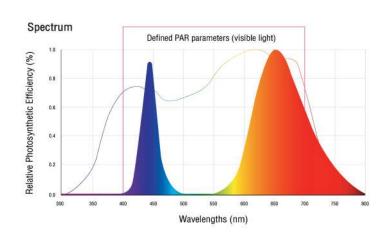
Color: Horticulture Pink

LED Lifetime: 40000 hours

Warranty: 2 year







Product	Power(W)	Color	Voltage(V)	Application
MG-I	20W	R/B Pink	220 On-Off Driver	Home planting





#### Mini Garden Series

#### Description

- L&E Mini-garden horticulture lighting is perfect for home and office planting to get more green space.
- · Excellent color saturation and good for human virtualization.
- · Simple design makes it compatible with any space.
- Auto on-off time 16/18 hours build-in driver.
- · Can be applied to aquatic plants.

#### Specification

Housing: Polyvinyl chloride (PVC)

Power: 14W

Input Voltage: 220VAC / 50Hz

PPFD: 180µmol/m²/s@ 20cm

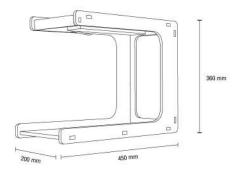
R/B ratio: 2.5

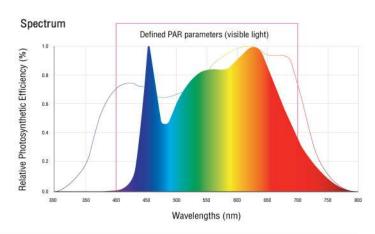
Color: Horticulture White

LED Lifetime: 40000 hours

Warranty: 2 year







Product	Power(W)	Color	Voltage(V)	Application
MG-F	14W	4000K	220 On-Off Driver	Home planting





#### **Proficient Series**

#### Description

L&E HLVP240S LED horticulture quantum board, high performance LED chip with full spectrum designed and suitable for indoor plants growth.

HLVP240S is equipped with dimmable mode for provide maximum plant growth at each stage and UV+IR mode to increase the quality of plants product.



#### Specification

Housing : Aluminum Alloy Finishing : Anodic oxidation

Power: 240W

Input Voltage: 100-240VAC / 50Hz

Power Factor: >0.9 THDi: <15%

PPFD:  $780\mu$ mol/m<sup>2</sup>/s@ 30cm  $590\mu$ mol/m<sup>2</sup>/s@ 40cm

Beam Angle: 120 degree

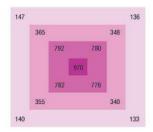
Function: - Horticulture mode

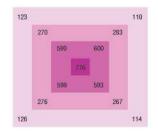
- Flowering mode (UV+IR)

Control: Dimmable with dimmer knob

LED Lifetime: 50000 hours

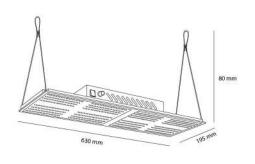
Warranty: 2 years

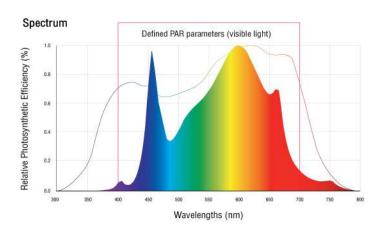




PPFD (area: 90x90 cm, hieght: 30 cm)

PPFD (area:90x90 cm, hieght: 40 cm)





Product	Power(W)	Voltage(V)	Application
HLVP240S	240W	100-240 Vac	Horticulture



#### **Proficient Series**

#### Description

- Essential spectrum for general plant with aesthetic color appearance
- Precise light distribution to reach high PPFD for vertical farming
- · Long lifetime with less energy consumption
- · Support and advice for your requirements

#### Specification

Housing: Aluminum Alloy

Control Gear: 1-10V Dimmable

Power: 650 W

Input Voltage: 230VAC±10% /50Hz

Power Factor: >0.9 THDi: <15%

Luminous Flux: >100000 lumen

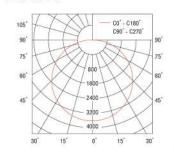
PPFD:  $770\mu$ mol/m<sup>2</sup>/s@ 45cm

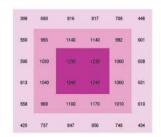
360µmol/m²/s@ 100cm

Color: Horticulture White Beam Angle: 115 degree Control: Dimmable 1-10Vdc LED Lifetime: 50000 hrs.

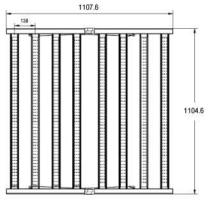
Warranty: 2 years

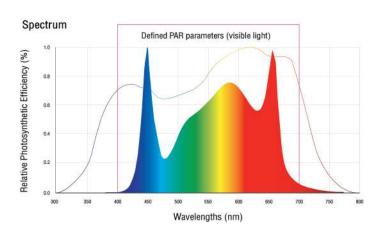
#### Polar Curve





PPFD (area: 120x120 cm, hieght: 30 cm)





Product	Power(W)	Voltage(V)	Application
HLCL650W	650W	230Vac	Horticulture





#### **Proficient Series**

#### Description

- Precise light distribution to reach high PPFD for plant farming
- Long lifetime with less energy consumption
- · Support and advice for your requirements

#### Specification

**Housing**: Aluminum Alloy **Finishing**: Anodic oxidation

Power: 600 W±10%

Input Voltage: 100-240Vac,50Hz

Power Factor: >0.95

PPFD:  $1150\mu$ mol/m<sup>2</sup>/s@ 45cm

890 µmol/m²/s@ 100cm

Beam Angle: 120 degree Control: Dimmable 0-10Vdc

IP Rating: 65

**Dimension**: 1177 x 145 x 36 mm.

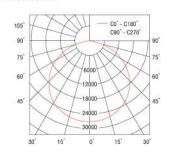
Weight: 11.6kg.

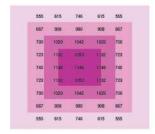
LED Lifetime: 50000 hrs.

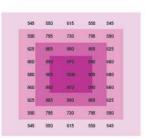
Warranty: 3 years

Dimension

#### Polar Curve

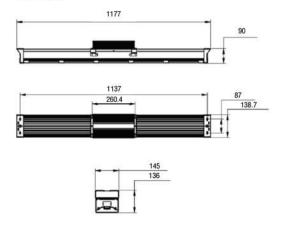


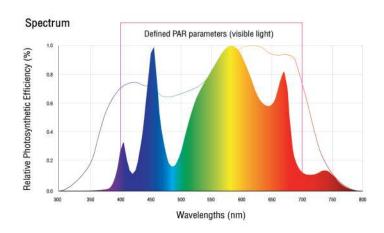




PPFD (area: 120x120 cm, hieght: 45 cm)

PPFD (area: 120x120 cm, hieght: 60 cm)





Product	Power(W)	Voltage(V)	Application
HLCL-06	600W	100-240 Vac	Horticulture



#### **Proficient Series**

#### Description

- High power LED with essential spectrum for general plant growth.
- Precise light distribution to reach high PPFD for plant farming.
- Suitable for human visual system and excellent color saturation.
- · Long lifetime with less energy consumption.
- · Support and advice for your requirements.

#### Specification

Housing: Aluminum Alloy and Acrylic cover

Finishing: Anodic oxidation

Power: 130 W±10%

Input Voltage: 100-240Vac,50Hz

Power Factor: >0.9

THDi: <15%

Luminous Flux : >16000 lm PPFD : 320µmol/m<sup>2</sup>/s@ 60cm

Beam Angle: 90 degree

Control: Dimmable 0-10Vdc (Optional)

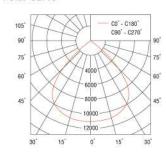
IP Rating: IP65

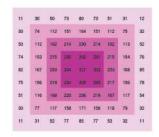
LED Lifetime: 50000 hrs.

Warranty: 2 years

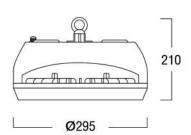


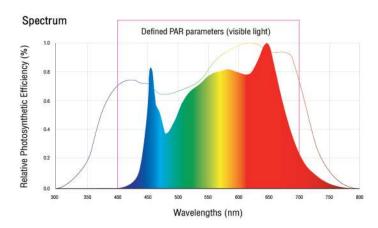
#### Polar Curve





PPFD (area: 120x120 cm, hieght: 60 cm)





Product	Power(W)	Voltage(V)	Application	
HLHBL731W	130W	100-240 Vac	Horticulture	



#### **Proficient Series**

#### Description

- Essential spectrum for general plant with aesthetic color appearance
- Precise light distribution to reach high PPFD for vertical farming
- · Long lifetime with less energy consumption
- · Support and advice for your requirements



#### Specification

Housing: Aluminum Alloy

Control Gear: 1-10V Dimmable

Power: 100W

Input Voltage: 230VAC±10% /50Hz

Power Factor: >0.9

THDi: <15%

Luminous Flux: >12000 lumen

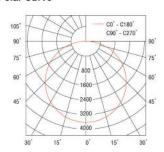
Color: Horticulture White Beam Angle: 115 degree Control: Dimmable 1-10Vdc

IP Rating: IP65

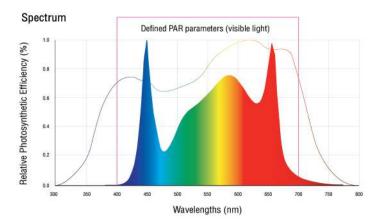
LED Lifetime: 50000 hours

Warranty: 2 years

#### Polar Curve







Product	Power(W)	Voltage(V)	Application	
HLCL100W	100W	100-240Vac	Horticulture	



#### **Proficient Series**

#### Description

- · Essential spectrum for general plant growth
- Precise light distribution to reach high PPFD for vertical farming
- Compact and durable aluminum housing with front glass
- Fully dust and water resistant with IP65
- · Support and advice for your requirements



Housing: Aluminum with front glass

Lamp Holder: Surface mounting

Control Gear: Build-in driver

Power: 50W

Input Voltage: 220-240VAC

Power Factor: < 0.9

THDi: <15%

PPFD: µmol/m²/s@ 45cm Beam Angle: 14, 36 degree

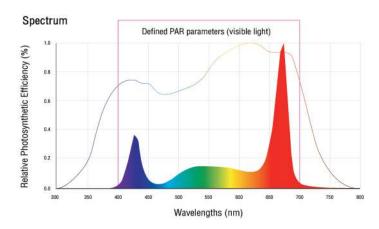
IP Rating: IP65

LED Lifetime: 25000 hours

Warranty: 1 years







Product	Power(W)	Color	Voltage(V)	Application
HLLNH01200RW	50W	1R1W	220-240VAC	Vertical Farming



## **Control Systems**

### **Functionalities**

Since our strategy is to provide lighting as a service, the incorporation of a control system that will allow to monitor and act according to needs is a fundamental part of the lighting system.

## Allows you to Customize appropriate Solutions Monitoring and Control of:

- Temperature
- Humidity
- Lighting
- · Watering

#### Remote Management:

- · Consumption monitoring
- · Fault reports
- · Possibility of interaction with integrated data
- · Access through WEB devices
- Georeferencing



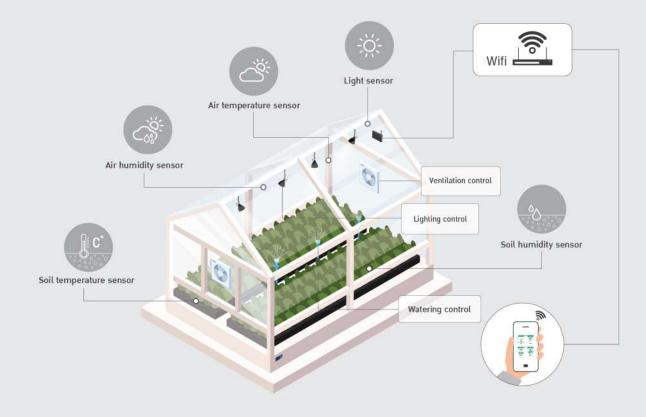








## **Smart Green House**



#### Dashboard





#### Sensor

#### Air Sensor



Temperature and Humidity Sensor adopts imported industrial grade microprocessor chip and introduces the latest foreigh measurement technology to ensure excellent reliability, high precision and good interchangeability. Widely used in building automation, climate and HVAC signal collection, greenhouse and pharmaceutical and chemical industries.

#### Soil Sensor



Module Soil Temperature and Moisture Sensor combines soil moisture and soil temperature sensor to facilitate soil moisture and soil temperature measurement. The product has high precision, fast response and stable output. It is less affected by soil salinity and is suitable for various soil types. It can be buried in the soil for a long time, resistant to long-term electrolysis, corrosion resistance, vacuum potting, waterproof and rust proof.

#### Light Sensor

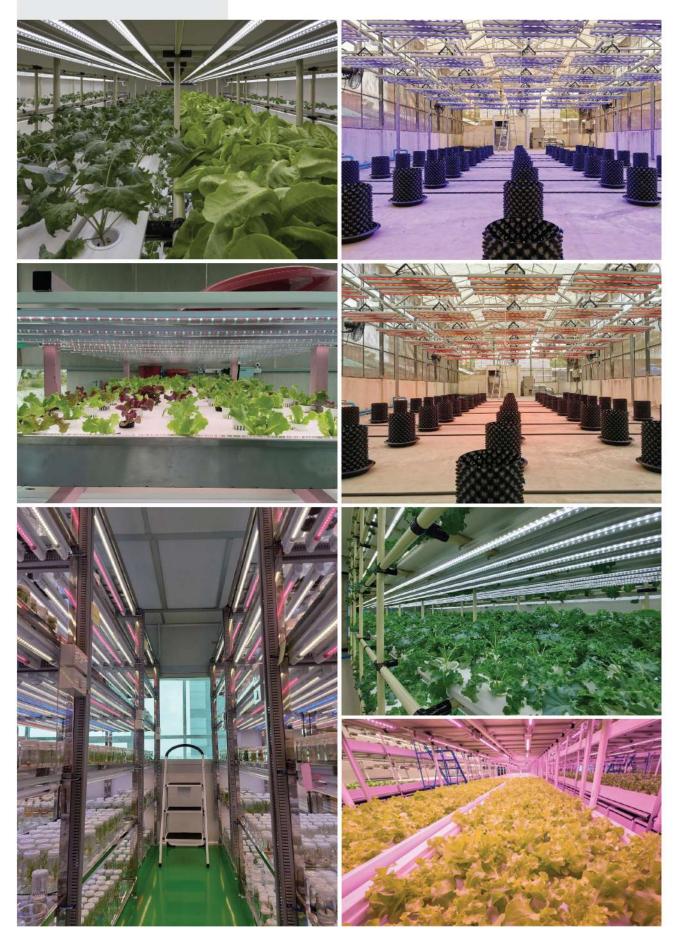


Low Price Digital Analog Meter Ligh Lux Sensor adopts wall-mounted installation and adopts imported illumination sensing device. It has the characteristics of high measurement accuracy, good stability, long transmission distance and strong anti-interference ability. Widely used in indoor and outdoor environmental monitoring, agricultural greenhouses, flower cultivation and other occasions where light intensity monitoring is required.





## Reference













#### Lighting & Equipment Public Company Limited

539/2, 16-17th FL., Gypsum Metropolitan Tower, Sri Ayudhaya Rd., Rajthevee, Bangkok 10400,

Thailand Tel: (66) 0 2248 8133, 🚮 lightingthailand, www.lighting.co.th