

TUNGSRAMTM

Innovation is our heritage
EST. 1896

GREENHOUSE SOLUTIONS

Tailored to your needs

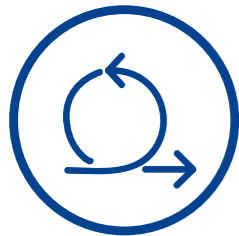


We are in the middle of a global change, and food security has been and will continue to be a key priority. World population is increasing, and this requires an increase in the total output of food, which is affordable, healthy and accessible to everyone at the same time.

It is time to change how we think about indoor horticulture and supplementary lighting. It is time to choose a high quality, professional and flexible LED lighting system that can best stimulate the development of your crop.

As an innovative company, Tungsram Agritech is convinced that the key to success is the application of new technologies. With 120 years of knowledge in the field of lighting techniques, Tungsram Group focuses specifically on greenhouse lighting and vertical farms. Our aim is to offer world-class quality LED lighting and smart-solutions to growers and farmers for use in their precision indoor farming operations.

WHAT WE OFFER



Customized LED solutions

Light tailored to Customer needs
Well-designed lighting plan
Simple installation



High quality from Europe

Compliance with EU standards
Outstanding product service
Long term warranty



Reliability and expertise

Highest quality components
Qualified engineers
Crop Advisors

How to Choose the LED System?

Several important factors need to be considered when selecting the LED system for your crop. We will take you through the key areas; however, our **experts and partners are always available to assist you.**

LED Optimized for Growth

When selecting the right LED system, you must first consider the required level of Daily Light Integral (DLI), which determines the total amount of photosynthetically active photons that are to be delivered to a specific area in a 24-hour period. Depending on the available amount of natural light, your crop may need supplementary lighting to meet the targeted DLI.

Once we know the quantity of missing light and the hours of lighting per day required for the horticultural production, the required PPFD (Photosynthetic Photon Flux Density) – which defines the total amount of PAR (Photosynthetically Active Radiation) reaching 1 m² of canopy surface per second – can be calculated. As soon as we know the key dimensions of the growing facility and the required irradiance, the right lamp can be chosen.

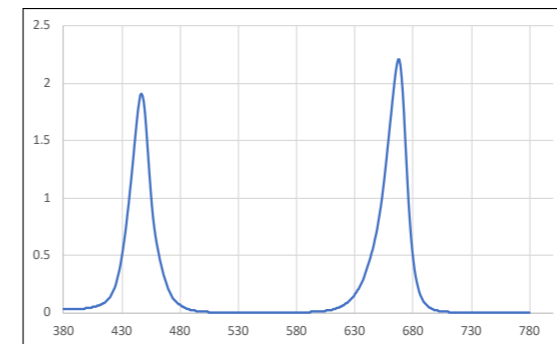
The Role of Color Spectrum

Autotroph organisms utilize wavelengths with different efficiencies. Wavelengths stimulate particular photoreceptors, which shall induce specific primary and secondary metabolic and other physiological processes of plants that result, for instance, in the production of proteins or flowers' opening. This phenomenon is called photomorphogenesis. Light radiation according to a defined spectrum, length of time and intensity, can significantly contribute to the desired plant growth. Increased irradiance can boost biomass production while the number of lighting hours can effect flowering. The basic components of spectrums used in horticultural production are red and blue, because the peak absorptions occur in these wavelengths.

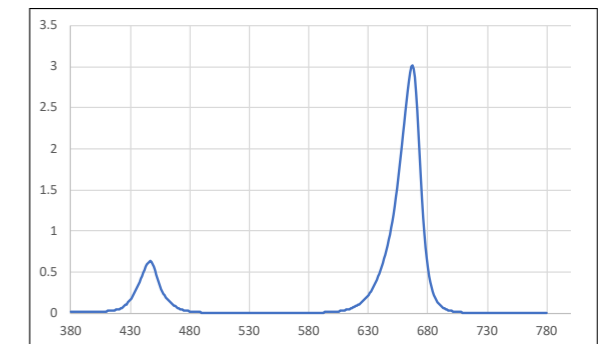
Additionally, other spectrums have beneficial effects, as well. Far-red can elongate stems, UV-B can raise essential oil content. One of the white full spectrum's benefits is that it allows a better light for the human work environment. Ratio of spectrums in a given phenophase or section of the day also influence the yield, the right ratios depend on the targeted results. Our standard range has fixed and variable spectrums that, in short, have the following benefits:

- The High Red, Low Blue product induces biomass production, promotes the flowering and fruit generation in the reproductive stage.
 - The High Red, Medium Blue product leads to vigorous and compact leafy plants with proper nutritional value.
- We can help define the right lighting strategy to meet your specific needs.

Spectral distribution



(High Red, Medium Blue)

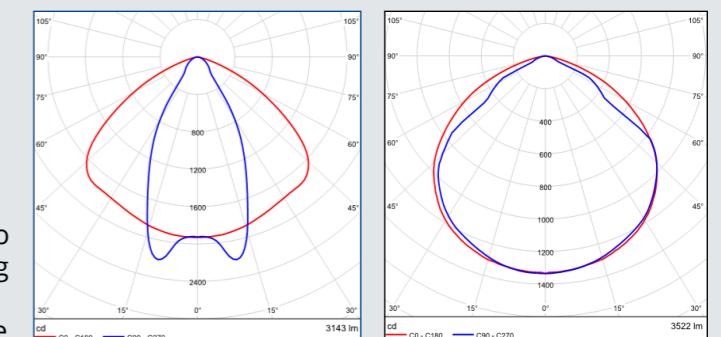


(High Red, Low Blue)

Optical Assembly

Our optical system of Tungsram Toplight products enables LEDs to provide optimized illumination for open floor and racked aisles with photometric distributions of 30, 50, 90 and 120 degrees. These optics have been designed taking into account the varying mounting heights, fixture spacings and light levels of the different horticultural applications. The choice of optic will depend on how deeply you require the light to penetrate the plants and the intensity of the light falling on the canopy. A wider optic will give you a broader light spread, while a narrower optic will result in a more intense light spread of a smaller area. We can calculate this for you once we know the height of the installation and the position of the plants.

Light distribution



(Narrow optics)

(Wide optics)

SINGLE AND DOUBLE LINEAR TOPLIGHT



Greenhouse LED Lighting



DESIGNED FOR GREENHOUSES AND VERTICAL FARMS

Tungsum Linear Toplight with its high light output reaching up to 3110 $\mu\text{mol/s}$, 3.67 $\mu\text{mol/J}$ efficacy and well selected radiation spectrum is the ideal replacement for traditional High-Pressure Sodium or Metal Halide systems. Its efficient heat dissipation system prolongs system life and offers better control over the climate of the greenhouse.

Key Technical Features

- High efficiency LED design, up to 3.67 $\mu\text{mol/J}$
- Available in fixed spectrum
- Simple hanging system and light weight to ease the installation
- IP66 Ingress protection
- Operating Environment 0 °C to +40 °C
- L90/B50 >50 000h (Ta= 25 °C)
- Low heat radiation compared to High Intensity Discharge lamps
- Passive cooling
- Impact resistant design made of glass and aluminum
- IK08
- Regulatory approvals – CE, RoHS

Benefits to Customers

- ✓ 1000W HPS replacement
- ✓ More than 50% energy saving compared to HPS Slim design to reduce shadowing
- ✓ Spectrum customizable to your needs All
- ✓ year-round production
- ✓ Increased yields and quality
- ✓ Long life time - low maintenance cost
- ✓ Ease of installation & cleaning
- ✓ Low heat radiation
- ✓ Remote driver
- ✓ Long warranty period
- ✓ Professional lighting design
- ✓ Crop advice
- ✓ After sales services

Product specifications

Product ID	Module	Growth Spectrum	Nominal Power (W)	PPF ($\mu\text{mol/s}$)	Efficacy ($\mu\text{mol/J}$)	Optic	Control	Mounting		
TUAS-GLIN	1	HRMB	32	104	3.2	C1-120°	F-Fix	H-Hook		
			175	516	2.94					
			311	904	2.9					
	2	HRMB	623	1808	2.9			L5-50°	D-DALI	B-Bracket
			28	104	3.67					
			150	513	2.41					
1	HRLB	296	986	3.33	L5-50°	D-DALI	C-Cable			
		513	1846	3.6						
		635	2074	3.27						

HRMB=High Red + Medium Blue, HRLB= High Red + Low Blue

*The indicated values are meant for 120° optic and fix versions.

Mounting and Installation

Simple hanging system and light weight to ease the installation. Various hook or bracket system options and cabling kits are available for the installation and connection of this product. On-request individual mounting solutions may also be developed.

Mounting hook (optional)

Available in all fixture configurations. Attachable to the structural element of the greenhouse.

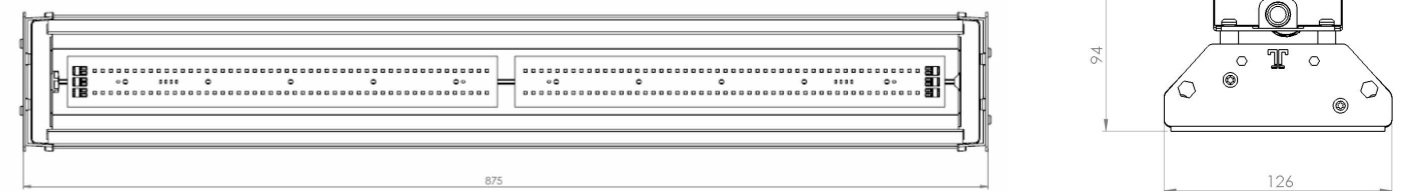
Y-Cable w/hook (optional)

Available in 1.5m, 3m, 4.5m, 6m lengths.



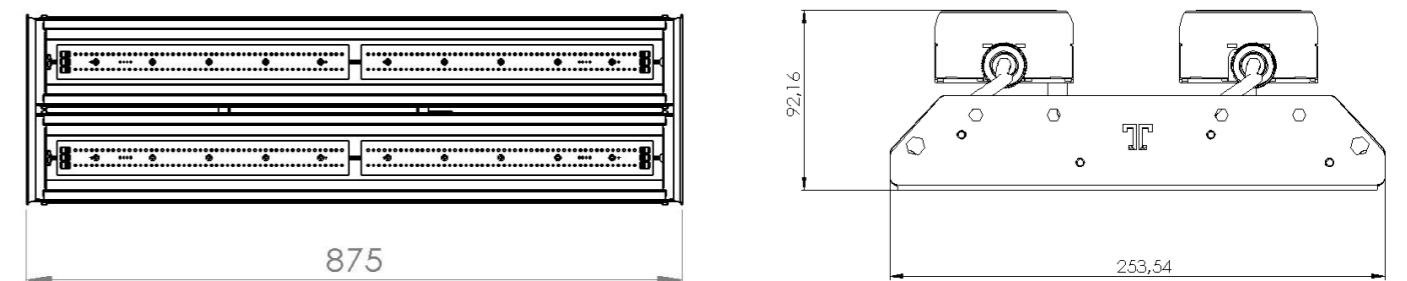
Single fixture dimensions (mm)

Max. Weight: 5 kg



Double Fixture Dimensions (mm)

Max. Weight: 10 kg





ENDLESS SPECTRAL VARIATIONS

When selecting the right LED system for a specific crop, one must first consider the desired growth spectrum and the amount of PPF (photosynthetic photon flux density). The Research fixture of the Tungram Agritech Series allows users to experiment with different mix of wavelengths and light intensity to define and finetune the most optimal light spectrum for given phenophases of all kinds of plants to achieve the targeted quantity and quality of primary and secondary metabolites.



Key Technical Features

- Highest PPF – up to 1183 $\mu\text{mol/s}$
- High efficiency LED design, up to 3.11 $\mu\text{mol/J}$
- Ingress protection: IP65
- IK08
- Operating Environment: 0°C to +40°C
- Life-time >50 000h (Ta= 25 °C)
- Low heat radiation compared to High Intensity Discharge lamps
- Passive cooling
- Impact resistant design made of glass and aluminum
- Regulatory approvals – CE, RoHS

Benefits to Customers

- ✓ Variable spectrum & light intensity
- ✓ Up to 5 channels, customizable to your needs
- ✓ UV LED 365-420nm (Optional)
- ✓ Wireless control
- ✓ Long life time
- ✓ Ease of installation
- ✓ Long warranty period
- ✓ After sales services

Advanced Control

- Innovative control system options for industrial scale and research cultivations
- Real time growing recipe management: timed dimming, grouped control, easy-to-adapt map view
- 0-100% dimmability on each channel ensures most versatile spectral variants and wide range of PPF density in each product

Product specifications

Product ID	Module	Growth Spectrum	Nominal Power (W)	PPF ($\mu\text{mol/s}$)	Efficacy ($\mu\text{mol/J}$)	Optic	Control	Mounting
TUAS-GTR	1	R/B/G/FR Variable	183	570	3.11	C1-120°	F-Fix	B-Bracket
	2		428	1183	2.76	L5-50°	D-DALI	C-Cable

R=Red, B=Blue, G=Green, FR=Far Red

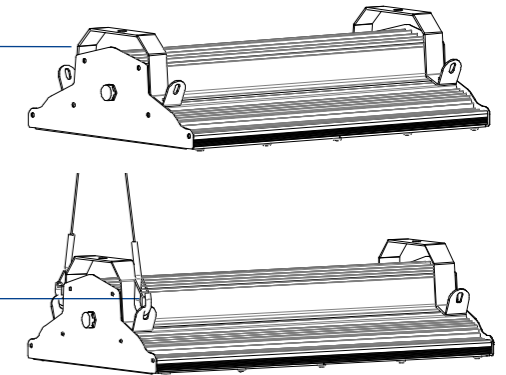
*The indicated values are meant for 120° optic and fix versions..

Mounting and Installation

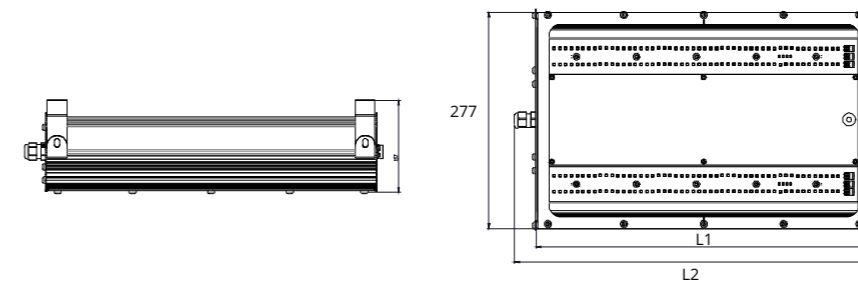
Simple hanging system and light weight to ease the installation. Various hook or bracket system options available for the installation and connection of this product. On request individual mounting solutions may also be worked out.

Rod Mount (included in the pack)
Available on all fixture configurations.
Attaches to M6 threaded rod.

Y-Cable w/hook (optional, order separately)
Available in 1.5m, 3m, 4.5m, 6m lengths.



Fixture Dimensions (mm)



	Single	Double
L1	422	842
L2	456	876
Weight	5kg	10kg

Remote Monitoring Systems

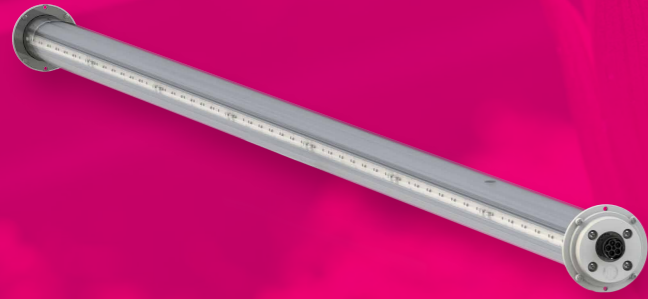
Tungram Agritech's IT solution monitors and remotely controls the environment and the daily operation of indoor farms. The development includes remote management solutions on Android, iOS and Windows platforms to monitor and verify the functioning of the control equipments through a web interface. In addition to this, we are working to develop AI and machine learning solutions using the data currently collected by the sensors, which are monitoring specific conditions related to plants and their environment.





LED OPTIMIZED FOR GROWTH

The Tungsram Interlight LED solutions serve as a supplementary light source in greenhouses to light the lower, shadowed parts of the canopy. Growers can choose from PPF 137-306 $\mu\text{mol/s}$ modules, supplying the high wired plants' entire surface with proper amount of light to maximize yields and ultimately improve taste and nutritional value of horticultural produces.



Key Technical Features

- High efficiency LED design, up to 3,42 $\mu\text{mol/J}$
- Fixed spectrum
- Passive cooling
- Low heat radiation
- Operating Environment: 0°C to +35°C
- L90/B50 life-time exceeds 50 000h (Ta= 25 °C)
- Ingress protection rating: IP66
- Impact resistant design made of PMMA and aluminum
- IK08
- Regulatory approvals - CE, RoHS

Benefits to Customers

- ✓ Slim design
- ✓ Low maintenance cost
- ✓ Customizable to your needs
- ✓ All year round production
- ✓ Increased yields and quality
- ✓ Long life time
- ✓ Long warranty period
- ✓ Ease of intallation & cleaning
- ✓ Resistant to commonly used chemicals

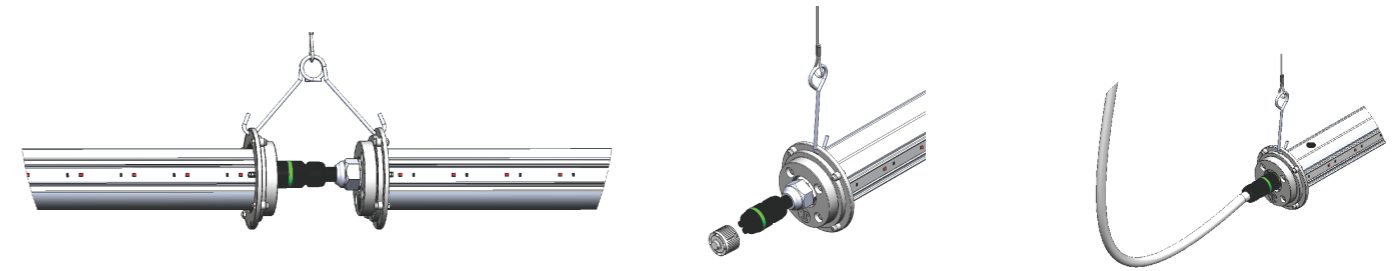
Product specifications

Product ID	Module	Growth Spectrum	Nominal Power (W)	PPF ($\mu\text{mol/s}$)	Efficacy ($\mu\text{mol/J}$)	Optic	Control	Options	Mounting
TUAS-GINT	1500	HRLB	41	141	3.42	C - Clear	FX - Fix	ST-Standard	HH - Hook
		HRLBW	42	138	3.29				
	2550	HRLB	72	246	3.42			EC-End Cap	
		HRLBW	73	241	3.29				
		HRLBW	98	306	3.12				

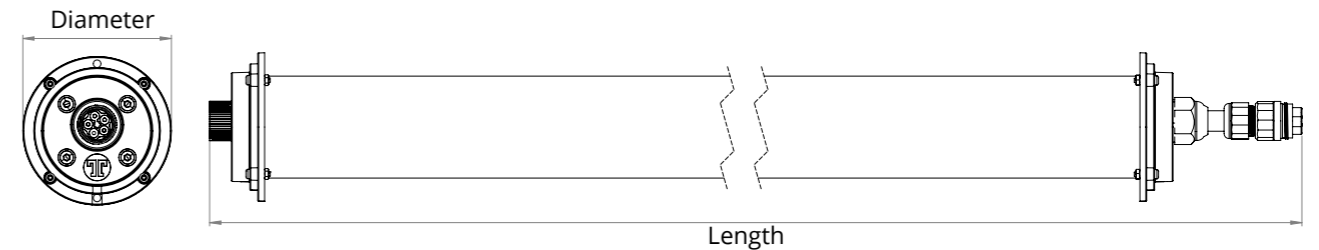
* HR= High Red, LB=Low Blue, W=White

Mounting and Installation

Simple hanging system and light weight to ease the installation. Product can be easily mounted with the cables and hooks provided in the pack. (Available with various cable length.)



Fixture Dimensions (mm)



Module	1500	2550
Max length (mm)	1508	2558
Diameter (mm)	87.5	87.5
Weight (kg)	2.63	4.45



Descriptions in this brochure are intended as a general guide, and we may change specifications from time to time to represent the enhancement of product development, without prior notification or public announcement. All descriptions in this publication present only general particulars of the products to which they refer and shall not form part of any contract. Data in this guide has been obtained in controlled experimental conditions. However, Tungsum cannot accept any liability arising from the reliance on such data to the extent permitted by law.

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