HORICULTURAL









OSRAM

HORTICULTURAL L I G H T I N G

CONTENTS

INTRODUCTION	04		
CHOOSING THE CORRECT SECONDARY OPTIC			
HORTICULTURAL TERMS / DEFINITIONS			
OPTIC FAMILIES			
HORTICULTURAL APPLICATIONS	07		
GREENHOUSES	08		
VERTICAL FARMING	09		
INTRA CANOPY	10		

LUMINUS

CREE ÷ COSRAM

www.carclo-optics.com

INTRODUCTION

The lighting industry is constantly advancing technology to meet the ever-growing demands in numerous sectors. We have seen these innovations occurring across multiple applications tailored for use in retail, office & warehouse settings.

The last few years has seen great strides in the field of the burgeoning industrial horticultural market, partly in response to the question 'how do we produce enough food to feed an increasing population?'.

This, paired with ongoing environmental concerns, has driven substantial developments in the field resulting in both highly optimised crop growth and hugely reduced energy use. The LEDs now available are tailored so as to only produce the exact frequencies required by the plant being cultivated and when paired with the right secondary optic, the light spillage is reduced to next to nothing.

Carclo design, manufacture and produce premium optics specifically designed to focus the light produced by LEDs for a multitude of applications. On the following pages, we offer a basic overview of horticultural lighting alongside a selection of optics that can be used to achieve fantastic results with LEDs from the following manufacturers:

ΜΝΙCΗΙΛ

OSRAM

Our team of design engineers offer technical support throughout the entire process and Carclo offer a custom design option for any bespoke project that falls outside the specifications of our standard range.

Our website has a searchable database that returns a number of solutions for a wide variety of applications.

For any questions relating to any of the products in this brochure, please contact our friendly sales team directly.

e: Bernard.Daniels@carclo-optics.com

e: Stephanie.Delaval@carclo-optics.com

CHOOSING THE CORRECT SECONDARY OPTIC?

Secondary optics are essential to control the powerful light emitted by today's LEDs.

NO LENS

WITH LENS*

As you can see from the visual representation, the light from LED without a lens streams out in all directions. This wastes both energy and finances. The yield increase requires high uniformity and with results above 90%, it is clear that the lenses offered by Carclo Optics for use in horticulture are the sensible choice.

PARAMETERS TO CONSIDER

- 1. Spatial distribution of light: The general light distribution will vary across optic types.
- 2. **Optical efficiency:** The Carclo Optics website has a large number of results for all optics / reflectors with various LEDs from the leading manufacturers.
- 3. Dimensions of the lens / reflector: Each luminaire will have a finite space into which the optic must fit. There are numerous mounting options such as glue, tape or holders and some optics have legs. The results can vary dependent on the height at which the optic is mounted. We offer different solutions to facilitate mounting heights and have results to illustrate this on Optic Select.

TERMS & DEFINITIONS

PAR • Photosynthetically Active Radiation

400nm - 700nm • This is the spectrum range that plants use for photosynthesis and corresponds roughly with the light visible to the human eye.

PPF • Photosynthetic Photon Flux • Unit: µmol/s

Amount of PAR produced by a light source per second OR the total number of photons per second with wavelengths between 400nm - 700nm.

PPFD • Photosynthetic Photon Flux Density • Unit: µmol/s-m²

Amount of PAR landing on a square meter per second OR density of PPF on a target surface.

DLI • Daily Light Integral • Unit: mol/day-m²

Total amount of PAR that lands on a square meter surface per day.

PPE • Photosynthetic Photon Efficacy • Unit: µmol/J

Efficiency of a light source for converting electrical energy into PAR light (in µmol/J).

PBAR • Plant Biologically Active Radiation

280nm - 800nm • According to ASABE*, plant biologically active radiation covers a more substantial range of light that affects plant biology.

CORRESPONDING TERMS

HORTICULTURAL LIGHTING		GENERAL LIGHTING	
PAR	(400nm - 700nm)	VISIBLE SPECTRUM	(380nm - 750nr
PPF	(Unit: µmol/s)	LUMINOUS FLUX	(lm)
PPFD	(Unit: µmol/s-m²)	ILLUMINANCE	(lx)
PPE	(Unit: µmol/J)	EFFICACY	(lm/W)

*The American Society of Agricultural and Biological Engineers is an educational and scientific organisation dedicated to the advancement of engineering applicable to agricultural, food, and biological systems. Founded in 1907 and head-quartered in St. Joseph, Michigan, ASABE comprises members in more than 100 countries.

Agricultural, food, and biological engineers develop efficient and environmentally sensitive methods of producing food, fiber, timber, and renewable energy sources for an ever-increasing world population.

ASABE membership is open to all-engineers as well as non-engineers-who are interested in engineering and technology for agricultural, food, and biological systems.

Carclo Optics

OPTIC FAMILIES

www.carclo-optics.com

BUBBLE OPTICS

The wide beam angles offered by bubble optics results in a broad coverage and high uniformity promoting greater yield. This makes them an excellent choice for horticulture lighting.

STRIP OPTICS

The directional distribution over the length of the strip is ideal for vertical farming - minimising light spillage thus conserving energy and keeping costs down whilst maximising growth.

MINI HUBBLE OPTICS

Available as single, 1x3, 2x2 & 2x3 arrays, the Mini Hubble range offers a range of beam types from narrow spots to wide and square. A cost effective, space saving solution for all horticultural applications.

C0-C180

C90-C27

carclo

33UP OPTICS

Cost effective, easy fit and perfect for larger luminaires, the 33UPs have great uniformity and are an excellent choice for

C0-C180

C90-C270

horticulture especially greenhouse top lighting.

Optics

TECHNICAL INFORMATION

- All polar patterns above are to illustrate general pattern types achievable with corresponding optic types.
- All results displayed in this publication are based on a consistent room size of **5m x 10m x 3.2m**
- LONGITUDINAL Light Distribution 0° 180°
- HORIZONTAL Light Distribution 90° 270°

www.carclo-optics.com

GREENHOUSE LIGHTING

Providing optimal growing conditions on an industrial scale is best achieved using a combination of elements. It is widely accepted that the most important of these is lighting. In partnership with the correct nutrition and adequate ventilation, the yield is maximised along with ROI. Initial outlay is quickly returned and the use of LEDs with our secondary optics ensures both minimal light spillage and adherence to environmental guidelines.

www.carclo-optics.com

VERTICAL FARMING

The term 'vertical farming' refers to the practice of growing crops in vertically stacked layers. It often incorporates controlled environment agriculture, which aims to optimise plant growth, and soilless farming techniques such as hydroponics, aquaponics, and aeroponics. Our optics focus the light resulting in minimal spillage and ensure optimal yield.

www.carclo-optics.com

INTRA CANOPY

This involves suspending or mounting light sources amidst the vegetation and can promote growth, yielding fantastic results - especially when selecting LEDs that cater for specific light frequencies.

Due to the variance in density and growing arrangements, it is best to consult directly with our team to discuss tailoring the best solutions for your individual projects.

GREENHOUSE

cd/1000lm

www.carclo-optics.com

XAMPLE NO 1	EXAMPLE NO.2		EXAMPLE NO.3
12781	12917		12917
90° 60° 170 170 255 30° 255 30° 0° 0° 0° 0° 0° 0° 0°	90° 60° d/1000lm	90 160 320 60° 60° cd/1000lm	90° 160 60° 60° 60° 60° 60° 60° 60° 6
Growing the Growin			
DADAMETEDS		EXAMPLE NO 2 12017	

PARAMETERS	EXAMPLE NO.1 • 12781	EXAMPLE NO.2 • 12917	EXAMPLE NO.3 • 12917
Average PPFD (µmol/s-m²)	25.0	59.3	34.1
PPFD Uniformity	93%	79%	91%
Total PPF Produced (µmol/s)	3,378	3,378	2,538
Total Power Consumption (W)	1,188	1,188	900
ADVANTAGES	>90% PPFD uniformity Less luminaires Less installation & maintenance costs	Very high PPFD values Less luminaires Less installation & maintenance costs	>90% PPFD uniformity High PPFD values (higher than Ex1) Similar or less power consumption

All results displayed in this publication are based on a room size of 5m x 10m x 3.2m

All results displayed in this publication are based on a room size of 5m x 10m x 3.2m

www.carclo-optics.com

09

INTRA Canopy

12781

12781

10403

; 10406

PARAMETERS	RESULTS ON DETECTOR (12781)
Average PPFD (µmol/s-m²)	59.0
PPFD Uniformity	58%
Total PPF Produced (Whole Room) (µmol/s)	19,200
Total Power per shelf row (W)	6,720

• All results displayed in this publication are based on a room size of **5m x 10m x 3.2m**

www.carclo-optics.com

THANK YOU FOR YOUR TIME

www.carclo-optics.com