

# Machine Vision Lighting Overview

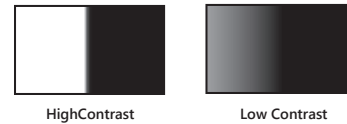
Generic lighting products are designed to provide basic illumination. However, lights designed for use as part of machine vision systems are designed with high-quality LEDs to provide consistent and uniform light across the desired field of view. Here are some considerations that should be kept in mind when designing an optimized machine vision lighting system.

## Goals for Machine Vision Lighting

### **Contrast**

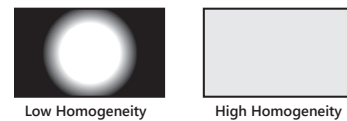
Maximizing contrast is the ultimate goal for any machine vision lighting system. If high contrast can be obtained, then detection is going to be a lot easier. In fact, maximizing contrast is the reason that most camera vision applications are monochrome. Contrast in monochrome images makes image processing easier.

To achieve the best contrast, the user must have a balance between homogeneity and brightness.



### **Homogeneity**

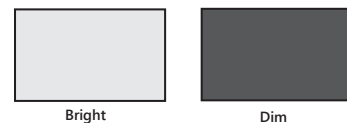
Homogeneity can be thought of as uniformity. The light needs to illuminate the whole field of view uniformly. Hot spots or dark spots remove contrast from specific regions of the field of view and can adversely impact vision accuracy, while a homogenous (uniform) field of illumination can greatly enhance accuracy.



### **Brightness**

Brightness, which is essential in creating contrast, is important in machine vision systems.

By increasing the brightness, system designers can create more robust systems using shorter exposure times. As an added benefit, this will also reduce motion blur.



It is true that if you put more current through an LED, it will get brighter. But one of the worst things for an LED's lifespan is over-current. Even though more current means a brighter LED, that brightness comes at a cost, for the brighter the LED gets the more heat is generated and the more its lifespan is reduced. In other words, the lifespan of an LED is directly related to the current through the LED.

The manufactures of our machine vision lights have taken great care in selecting the brightest and highest quality LEDs. They have also carefully engineered these lights to maximize light output and LED lifespan in order to deliver a product that will work consistently well for a long period of time. For instance, in order to achieve higher brightness, some of our lights can be strobed with higher current. In these lights, built-in microprocessors manage strobe duration to maximize brightness without adversely impacting life expectancy of the LEDs.

## Dealing With Ambient Light

One of the hardest things to design out of a machine vision application is the ambient light present in the location where the system will be used. Ambient light varies greatly from location to location, so designers must keep potential ambient light impacts in mind when designing machine vision lighting systems.

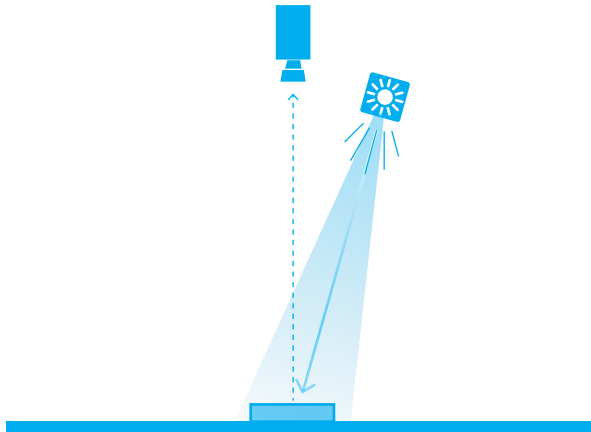
A common misconception is that ambient light comes only from overhead. However, the truth is that ambient light can come from several sources. Among the conditions which can impact ambient lighting are sunlight through a window, the reflection off of a reflective surface, or even a shadow.

There are situations in which building a shroud around the inspection area is the most appropriate way to deal with ambient light. In other situations, the best way to deal with it is to increase the brightness of the light source.

# Machine Vision Lighting Overview, continued

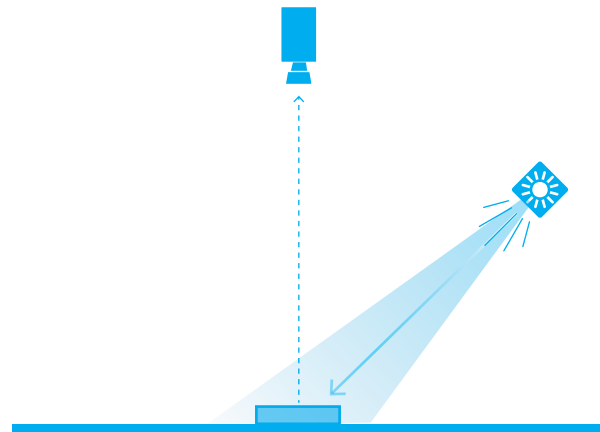
## Lighting Principles

Effective machine vision lighting relies on several factors, including what is known as the “angle of incidence.” Angle of incidence is defined as the angle at which the light strikes the object being illuminated. This angle is measured from an imaginary line between the camera and the light source. The examples below illustrate how different lighting angles can be used in various applications.



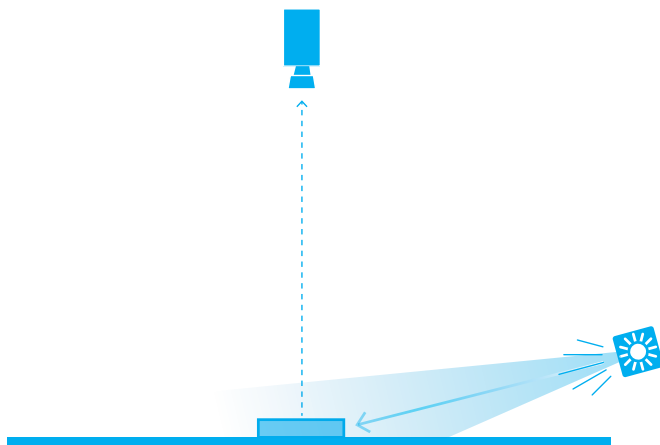
### **Bright field**

- Usually, the angle of incidence is between 0 and 30 degrees.
- Bright field is the easiest type of lighting principle for humans to understand, because this is how we generally see the world. However, this type of lighting system may not be well suited for use where shiny parts are involved.
- Diffusers or polarizers might be needed to decrease the unintended direct reflections.



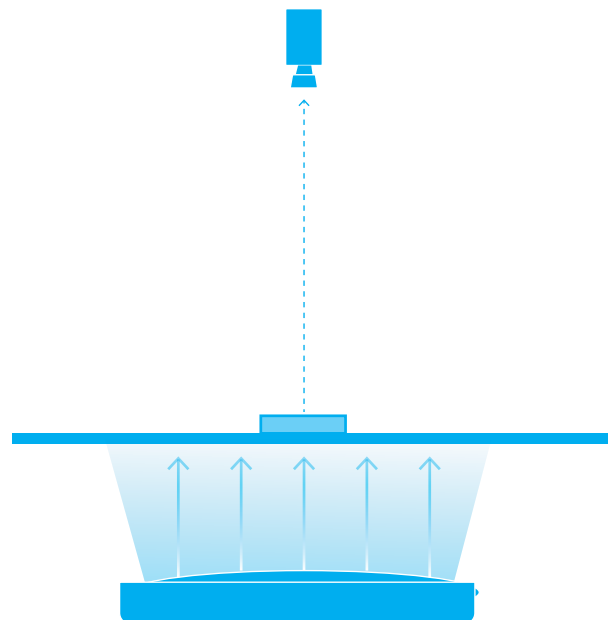
### **Low angle**

- Usually, the angle of incidence is between 30 and 80 degrees.
- The lighting source is placed between the dark field and the bright field so that the user can take advantage of both illumination methods.
- Good for engravings



### **Dark field**

- Usually, the angle of incidence is between 80 and 90 degrees
- This lighting configuration will generally bring high contrast to the edges. For parts that are not shiny, a narrow beam angle is usually best. For shiny parts, a diffused light source usually works best.
- Applications include edge detection and measurement.



### **Backlight**

- The light source is placed behind the object.
- When using this method, it is important that the light is bigger than the field of view.
- Backlighting light sources should be highly diffused and offer high homogeneity.
- Backlighting makes it possible to see a silhouette.

# WenglorTPL Vision Lighting Flat Dome Light **wenglor** TPL



**OPT2435**

WenglorTPL Vision's Flat Dome Light is a high-power flat dome illumination solution for machine vision applications such as Pick and Place or Logistics. The LEDs are mounted with highly efficient lenses, engineered to distribute the highest brightness and uniformity balance available for machine vision applications.

The Flat Dome Light also also features integrated current control, making it easy to wire, install and use. The central opening allows for simple placement of cameras using lenses up to 65mm [2.56 in] in diameter.

| WenglorTPL Vision White Illumination Flat Dome Light Selection Guide |            |                         |             |               |           |                      |                     |
|--|------------|-------------------------|-------------|---------------|-----------|----------------------|---------------------|
| Part Number  | Price      | Color of Light Emission | Temperature | Area of Light | Overdrive | Mode of Operation    | Drawings            |
| <a href="#">OPT2435</a>  | \$1,002.00 | White                   | 5700K       | 200 x 200mm   | No        | Continuous or strobe | <a href="#">PDF</a> |
| <a href="#">OPT2437</a>  | \$1,432.00 |                         |             | 300 x 300mm   |           |                      | <a href="#">PDF</a> |

| WenglorTPL Vision Infrared Illumination Flat Dome Light Selection Guide |            |                         |            |               |           |                      |                     |
|---|------------|-------------------------|------------|---------------|-----------|----------------------|---------------------|
| Part Number   | Price      | Color of Light Emission | Wavelength | Area of Light | Overdrive | Mode of Operation    | Drawings            |
| <a href="#">OPT2436</a>   | \$1,169.00 | Infared                 | 850nm      | 200 x 200 mm  | No        | Continuous or Strobe | <a href="#">PDF</a> |
| <a href="#">OPT2438</a>   | \$1,682.00 |                         |            | 300x300 mm    |           |                      | <a href="#">PDF</a> |

| Part Number             | Price   | Description      | Material  | QTY in Package | Drawings            |
|-------------------------|---------|------------------|-----------|----------------|---------------------|
| <a href="#">OPT2433</a> | \$82.00 | Mounting Bracket | Aluminium | 4              | <a href="#">PDF</a> |

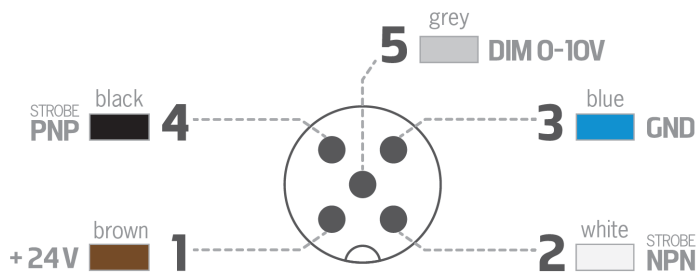


**OPT2433**

# WenglorTPL Vision Lighting Flat Dome Light **wenglor**TPL

| Flat Dome Light General Specifications                                    |  |
|---|--|
| <b>Electronics</b>  |  |
| <b>Power Supply</b>   | 24VDC ±10%   |
| <b>Functioning Mode</b>   | Continuous or strobe   |
| <b>Strobe Input</b>   | PNP: From 5 to 24V for 100% ON. From 0 to 1V for 100% OFF<br>NPN: Less than 1V for 100% ON. Above 2V for 100% OFF. Max 20V |
| <b>Overdrive</b>  | No   |
| <b>Strobe Conditions (ON time, duty cycle)</b>                            | No restriction   |
| <b>Dimming</b>  | Pin 5 (M12 5-pole connector): 0-10 V = 100-30% respectively  |
| <b>Maximum Rising Time</b>  | 15us   |
| <b>Maximum Falling Time</b>   | 10us   |
| <b>Control</b>  | Conector M12 5 poles   |
| <b>Consumption</b>  | White: 21.6 W (OPT2435), 48.6 W (OPT2437)<br>Infrared: 27.5 W (OPT2436), 61.9 W (OPT2438)                                  |
| <b>Minimum Functioning Voltage</b>  | 20V at the light input   |
| <b>Normal Functioning Voltage</b>   | 24V at the light output (±10%)   |
| <b>Maximum Functioning Voltage</b>  | 30V at the light input   |
| <b>Maximum Consumption Strobe Signal On Largest Product (400x400 mm)</b>  | 250mA  |
| <b>Maximum Consumption Dimming Signal On Largest Product (400x400 mm)</b> | 150mA  |
| <b>Optics</b>   |  |
| <b>Color</b>  | White (5700k)<br>Infrared (850nm)  |
| <b>Mechanics</b>  |  |
| <b>Thickness</b>  | 45mm   |
| <b>Internal Diameter</b>  | 65mm   |
| <b>Weight</b>   | 23.8 kg/m <sup>2</sup> ±15%  |
| <b>Materials</b>  | Aluminum and loaded ABS  |
| <b>Diffuser</b>   | White PMMA   |
| <b>Mounting</b>   | 4 M4 nuts (supplied) to insert in the groove<br>or 4 M4x20 screws (not supplied) applied to the corner slots               |
| <b>Environment</b>  |  |
| <b>Operating Temperature</b>  | -10°C to 40°C / 80% humidity without condensation<br>No thermal shock (maximum temperature variation 10°C in 24 hours)     |
| <b>Storage Temperature</b>  | -20°C to 60°C / 80% humidity without condensation<br>No thermal shock (maximum temperature variation 10°C in 24 hours)     |
| <b>IP Protection</b>  | IP40   |

## Connections



| Strobe PNP |               | Strobe NPN |               |
|------------|---------------|------------|---------------|
| 1          | +24V          | 1          | +24V          |
| 2          | Not connected | 2          | NPN           |
| 3          | Ground        | 3          | Ground        |
| 4          | PNP           | 4          | Not connected |
| 5          | Dim 0-10 V    | 5          | Dim 0-10 V    |

| Continuous Mode |               |    |               |
|-----------------|---------------|----|---------------|
| 1               | +24V          | OR | +24V          |
| 2               | Not connected |    | Ground        |
| 3               | Ground        |    | Ground        |
| 4               | +24V          |    | Not connected |
| 5               | Dim 0-10 V    |    | Dim 0-10 V    |