ADVANCED ILLUMINATION

Frequently Asked Questions about LED Illumination

Why LEDs?

LEDs offer long life and stable, solid state performance. Available in a wide range of colors, LEDs are versatile, energy efficient, and economical.

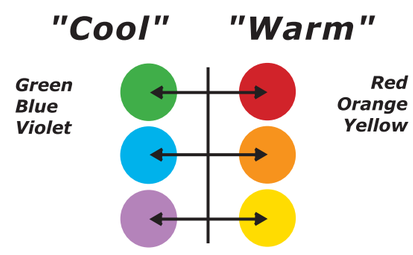
If red LEDs last so long why use other colors?

Though many inspections use black & white CCDs, the choice of light color is still important. ***Increasing Contrast with Colored Light*** is the process of using light color to either isolate or diminish colored portions of an object by using like or opposite colors.

Typical Color Use

White	WHI	Used with color Camera systems
Infra-red	880	Very long life. Works well on plastics. Often used when strobing would irritate employees.
Red	660	Used most often due to long life.
Orange	625	To increase contrast in colored samples. (see Increasing contrast chart)
Yellow	590	
Green	520	Often used on reflective metals and glass to lessen glare. Or to increase contrast in colored samples. (see chart)
Blue	470	

Increasing Contrast with Colored Light

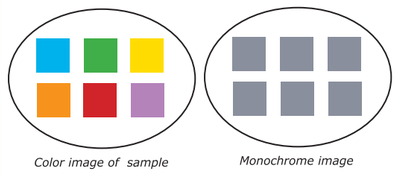


Significant contrast is achieved when opposing "warm" and "cool" colors in an inspection. Warm colors (red, yellow, orange), when cast upon cool colors (blue, green, violet) will darken the "cools" and lighten other "warms." The reverse is also true.

In addition, the greatest degree of contrast is gained by using opposing colors. Using opposite colors against one another offers the greatest potential for monochrome contrast.

White / Ambient Light inspection

As an example:
An inspection of 6 colored boxes for the presence/absence of a single color.



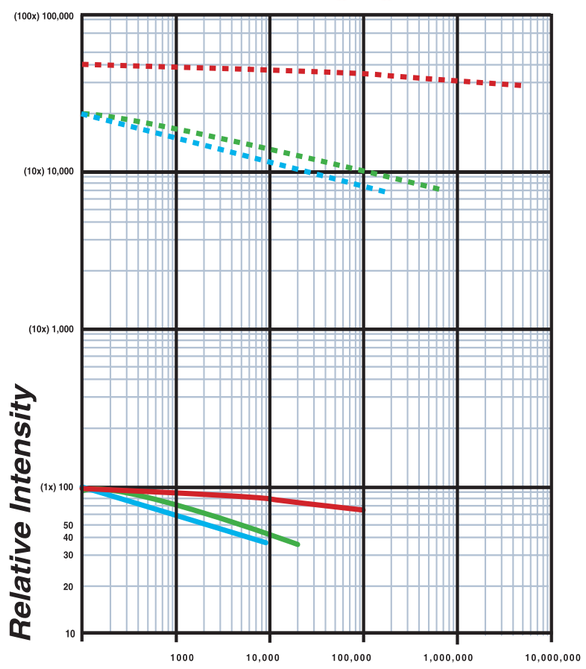
The monochrome camera, using white or ambient light, is unable to render significant contrast between the colored boxes.

Inspections using Selective Color

Why strobe?... and what is "Turbo Charging" an LED?

In fast moving inspections, using a strobe stops action in order for the camera to capture a clear image. When synchronized with the camera shutter, the strobed light will provide maximum intensity when the shutter is opened widest. Strobing becomes Turbo Charging when short bursts of high current are forced through an LED, increasing intensity. An added benefit of strobing is extending the life of the LEDs.

Increased LED Life Expectancy with Turbo-Charging

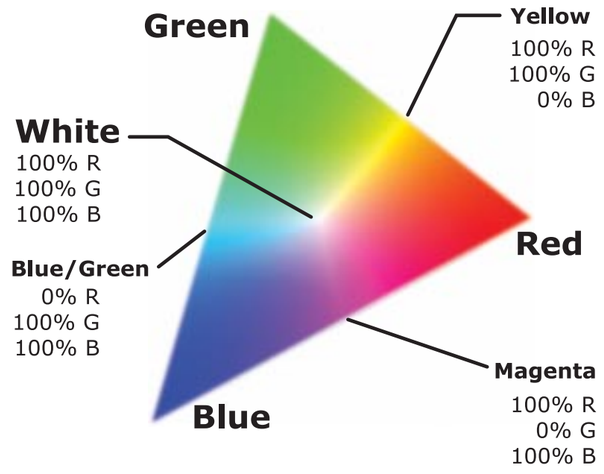


Turbo-Charging : More Power, Longer Life

Strobing the blue and green LEDs with typical machine vision duty cycles (~ .1%) and a current of 400 m amp, greatly improves power output by a factor of ***20x*** and the lifetime by a factor of ***50x.*** An even greater increase is acheived when "Turbo-Charging" the Red (660) LEDs.

LED lifetime based on 20 milli amp, DC current

Color Variations using RGB



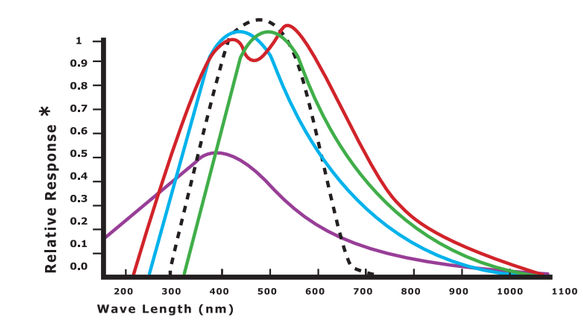
How useful are filters in an inspection?

Among other things, filters remove unwanted light, isolate specific colors, or decrease glare in an inspection. *Band Pass* filters allow only a narrow range of light through to the camera. In settings where ambient light creates an inconsistent variable, the band pass filter removes all but a specific range of light, eliminating the need for a shroud around an inspection area. Band Pass filters can also help isolate a color or range of colors within an inspection. *Cut Off* filters allow light above or below a specific wavelength to be visible to the camera. *Polarizing* filters help regulate the amount of glare from many specular objects.

How is color related to Camera Sensitivity?

CCDs come in a range of spectral sensitivities and can be specifically matched to light color in order to optimize the light - the greater the intensity range available to the camera, the greater the ability to control the light with either shutter speed or by adjusting the aperture.

Camera Sensitivity

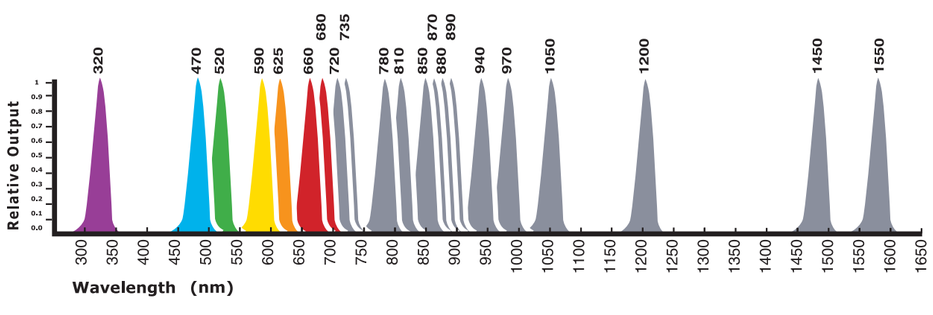


Camera Type
- Extended Infra-red
- Regular CCD
- Blue Enhanced
- UV Enhanced
- IR-Cut Filter

Suit your camera to your product and increase the response of your vision system.

*Averaged responses from major camera manufacturers.

LED Wavelength

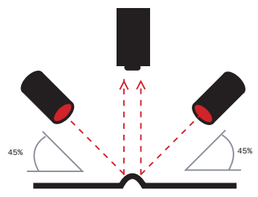


What are the most common lighting techniques?

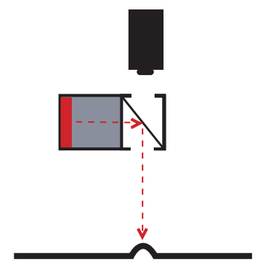
The goal of any machine vision lighting is to provide clear, uniform illumination so the vision system can properly recognize specific features or attributes. Although each inspection offers different challenges, certain lighting elements - including color, intensity, and speed – need to be considered for every application.

Common Lighting Techniques

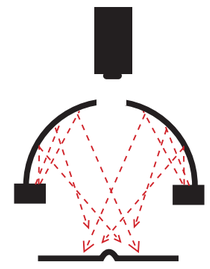
Direct Light: Light is projected directly at the object, much like a theatrical spot light aims a beam of light at a performer on stage.



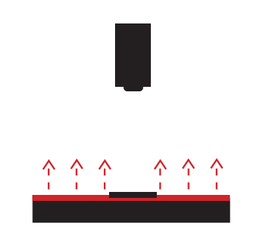
Darkfield: Angled light causing variations on a surface to deflect light up into the camera, creating light spots on a dark background or field. If there are no aberrations in the surface, nothing will be seen.



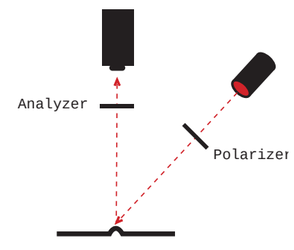
Co-Axial Illumination: A perpendicular wall of light is aimed at an angled beam splitter that reflects the light down. The object is viewed through the beam splitter.



Diffuselite: Reflected light, providing a non-directional, softer illumination that doesn't create harsh shadows. Often called Cloudy Day Illumination because it simulates the light on an overcast day.



Backlighting: An even area of illumination projected from behind an object. The object is seen as a silhouette by the camera.



Polarized Lighting: Polarizing filters are used to limit the amount of glare from an object. Light is projected through a polarizing filter, and then seen by the camera through an "analyzer". The direction of light can be modified by adjusting the orientation of the analyzer.

SL1236-520

SL2507-660

SL2420-470

SL4301-660

AL1248-660

AL26120-470

AL2730-660

DL37100-660
3" x 3"

DL7248-520

DL2230-WHI

DL38144-660
4" x 4"

DL9160-RGB

DL2449-660
2" x 2"

BL18120-660
4" x 8"

DL3316-660
1" x 1"

CL066-660
1" x 1"

BL2850-660
2" x 6"

BL41192-660
6" x 8"

BL1520-660
2" x 2"

BL1960-660
4" x 4"

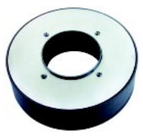
BL5420-660
1.5" Diameter

WL3248-660

WL3424-660

RL2316-625

RL3940-660



RL35120-WHI

RL4260-660

RL1660-660

LL3024E-WHI
6"

LL2912E-WHI
3"

RL2115-520

RL1360-470

RL1424-WHI

RL3536-WHI

LL3148E-WHI
12"

CS100
Current Source

CS410
Constant Current Source

MS220 / CS420
Dual Interfaces

S6000
Strobe Controller

CS300
Dual Output Current Source

MS210
Channel Mixer

S4000
Strobe Controller

Advanced illumination 24 Peavine Drive Rochester Vermont 05767
Phone 802.767.3830 Fax 802.767.3831

www.advancedillumination.com