



KONICA MINOLTA

THE STANDARD IN MEASURING
COLOR, LIGHT & DISPLAY



Understanding Color Rendering Index

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Introduction

LED lightings awareness and use are growing. While CFLs remain the choice for many households, many are switching to LED lighting as these lightings are more efficient with much lower power consumption and emits virtually no heat and last much longer. On the creative end, LED lighting comes in a myriad of colors to satisfy the discerning consumer.

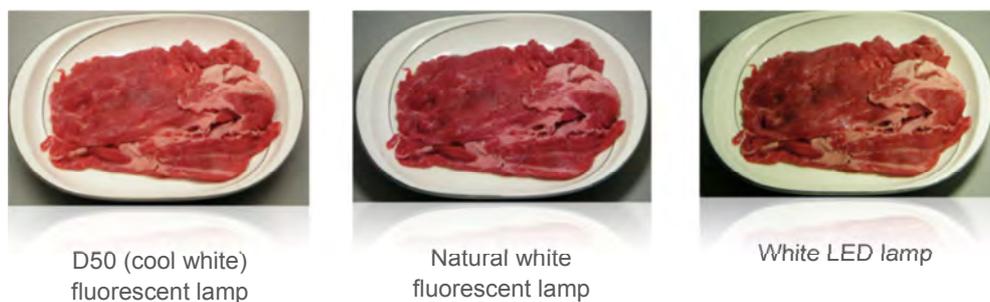
Understanding Color Rendering Index

There are many types of light source, from natural sunlight to man-made artificial lightings.

For assessment or comparison of color of objects, the standard practice is to compare colors under natural light (under the sun) or using simulated using fluorescent lamps (match to the natural sunlight spectrum). With LEDs been increasing adopted, there is a need to ensure that LEDs lighting renders objects close to natural lighting.

Lighting that produces color similar to that of natural light is said to have a good (high) color rendering property.

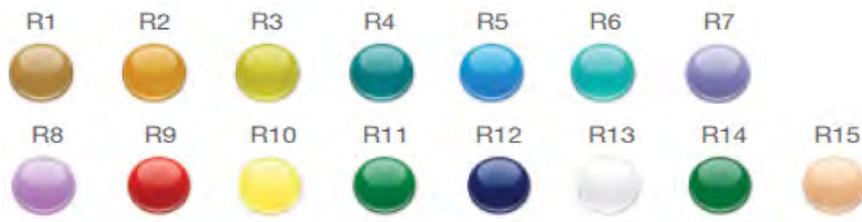
Commercially available lighting like incandescent, fluorescent and LED comes with descriptions such as “white”, “warm white” or “cool white” reproduce the color of an object differently. The following images showed the same object illuminated with three different types of lighting.



The colors looked different and this is due to the color rendering property of the lamps. This performance is called color rendering index or commonly known as CRI.

The R of Color Rendering Index

CRI indicates how 15 test colors look under a lighting. When comparing lighting against the standard reference light source, a CRI index of 100 is the best.



Ra is the “mean color rendering index”. It is the average of R1 to R8. These colors represent the typical colors of the general environment and things we used.

R9 – R15 are “special color rendering indices”. These ‘special colors’ are of relatively high chroma for red, yellow, green, blue and yellow. R9 is to evaluate the reproduction of red and is important for medical use. R15 is for skin tones.

The highest possible for each individual CRI is 100 and a negative value for certain light sources like low pressure sodium lighting indicates poor color rendering properties. This rating describes how a light source makes the color of an object appear to human eyes and how well subtle variations in color shades are revealed.

The higher the CRI rating, the better its color rendering ability.

The color quality of light is rated as the color rendering index (CRI). CRI describes the ability of a lamp to render the “true” color of object as seen by natural outdoor sunlight.

A CRI of 100 is a perfect match to natural daylight. Good lamps are rated around CRI 95, a close match to natural daylight.

Why Is It Important?

Light sources with a high CRI are important in hospital care, photography and videography in order to see color correctly. Health professionals need to see the ‘true’ colors in order to diagnose accurately. Pictures and videos will look realistic when ‘true’ colors are reproduced.

In home and workplace, good CRI lightings give ‘true’ color and is important for safety and wellness.

CRI Illuminance Meter

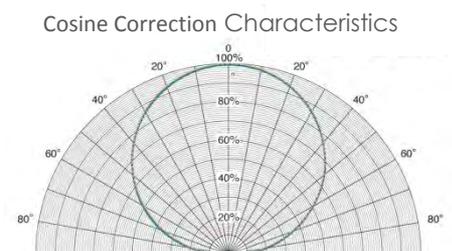
A photometer is an instrument for measuring lighting. For lighting measurement, an illuminance photometer measures illuminance (lux), color temperature (K), chromaticity (xy), color rendering index (CRI) and many other technical parameters.

The measurement of CRI is a precise and complex science.

Good CRI meters must have spectral sensor with an adjustment function that allows the CRI meter to match the human eye's respond as specified by Commission International de l'Eclairage (CIE), the international authority on light, illumination, color and color spaces.

Not all CRI meter's performance criteria are the same, and one may feel overwhelmed by the terminologies and specifications. Here are some important performance criteria for a CRI meter that meets regulatory requirements and performance.

- Visible-region relative spectral response characteristics (f_1')
- Cosine (correction) response (f_2)
- Temperature characteristics (f_T)
- Humidity characteristics (f_H)
- Accuracy
- Repeatability (2σ)



The first thing that comes to mind is accuracy. How do we deem accuracy? Make sure the CRI illuminance meter meets industrial standards bodies.

Good CRI illuminance meters must be manufactured and conformed to international recognised standards. For photometers, industrial standards and governing bodies classify photometer according to the accuracy and design.

- DIN 5032 Part 7 (Class A, B or C)
- JIS C 1609-1: 2006 (Class Precision, AA or A)

Based on its performance, CRI meters are generally classified into the above classes.

Selecting A CRI Illuminance Meter

Not All CRI Meters Are the Same

CRI meters use sophisticated sensors and are useful tools used in light designing and operation. Meters need to meet regulations set by governing bodies to ensure quality, protection, safety and proper usage.

Is Your Meter “Human”?

CRI meter must have filters or adjustments to match the human eye and this is specified in Commission internationale de l'éclairage (CIE). The international authority on light, illumination, color, and color spaces.

Is Your Meter “Corrected”?

Cosine correction is an absolutely important factor for light measurement to get accurate reading. Cosine correction is to correct the angle of light which is directed to the CRI meter's sensor.

Is Your Meter “Certified”



DIN
Deutsches Institut für Normung e.V.
German Institute for Standardization



JIS
Japanese Industrial Standards
日本工業規格



CIE
International Commission on Illumination
Commission internationale de l'éclairage

How Far Can Your Meter Go?

From interior spaces to outdoors, with general lighting to demanding visual task. A wide measuring range meter makes you versatile.

More on Lighting Terminology

Konica Minolta produces a range of light measurement equipment and resources to help you accurately measure light. To understand lighting technologies in more details, Konica Minolta's 'The Language of Light' booklet explains lighting terminology in simple terms and the techniques used to measure light like Illuminance, luminance, CRI, chromaticity and correlated color temperature.

For a free copy of Language of Light write to ssg@konicaminolta.com.



Selecting a CRI Illuminance Meter Checklist

Specifications	Information	Yes	No
Color Rendering Index	Ra: R1 to R8		
	Ri: R1 to R15		
Industrial Standards	DIN 5032 Part 7	Class A	
		Class B	
		Class C	
	JIS C 1609-1: 2006	Class AA	
Class A			
Spectral Response ¹	% of spectral luminous efficiency V (λ)		
Cosine Correction ²	Within %		
Accuracy ³	Ev: $\pm\%$ and xy: $\pm\%$		
Repeatability (2 σ) ⁴	Ev: $\pm\%$ and xy: $\pm\%$		
Range ⁵	Does it meet your work requirement?		
Minimum Illuminance Display ⁶			
Correlated Color Temperature			

¹ The lower, the %, the better the performance.

² Desirable response of the sensor. A small value is preferred.

³ A small value is preferred.

⁴ Look out for two sigma accuracy.

⁵ A wide range is preferred for almost all lighting applications including specialised lighting like surgery lighting.

⁶ This is the meter operating range.

About Konica Minolta Sensing

Konica Minolta Sensing is 'The Standard in Measuring Color, Light & Display'. Konica Minolta provides advanced optical technology that precisely measures the elements of color and light. Our products are a staple in research and manufacturing environments, helping organizations to meet product quality and operational goals with less waste, time, and effort. This commitment to creating value for customers is the core principle behind the Konica Minolta brand. It's also the driving force behind the high level of quality and precision built into each of our products and why we're the technological leader in color and light measurement solutions today.

In 2012, Konica Minolta Group acquired Instrument Systems GmbH, a major German lighting measurement equipment manufacturer of light measurement instruments such as spectrometers, imaging photometers and colorimeters. The acquisition provides Konica Minolta an even broader product line in the display measurement field where the company has the top share and further assist in maintaining its leading position in comprehensive light source measurement including the fast-growing LED light source and the organic-LED (OLED) Lighting.

Konica Minolta being the leader in the color, light and display measuring field have a wide array of educational materials. We believe in knowledge is the key to solving.

Here are some of our lighting technology educational booklets:

1. Understanding Color Rendering Index
2. Language Of Light
3. Lighting Technologies Principle and Measurement
4. Color Educational Series - LED Metrology

For more information and a copy of our educational booklets, write to us at ssg@konicaminolta.sg today.



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