OFFICE LIGHTING:
A Balance between Efficiency & Well-Being

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Dario Piermatteo is a Field Application Manager at Khatod Optoelectronic, specializing in innovative optical solutions. With over a decade of expertise in lighting and optoelectronic components, he combines technical knowledge with market insights. A Biomedical Engineering graduate with training in Strategic Marketing, he excels in product development using injection molding, extrusion, and casting. His work advances Khatod's mission of delivering high-quality optical solutions.

Most of our waking hours are spent in closed spaces and the only light we see is artificial. This is especially true in office lighting, where we not only spend a great amount of time, but also perform demanding tasks. In these spaces we long for natural light to give us a boost in the day-by-day activities, and often, the only light we get is at dawn, dusk, or coming from a window.

Office lighting has a great goal: it must mimic natural light in all its aspects. This is a starting point for luminaire makers: to put the Sun in a small box and have it switched on and off at will. A challenging task.

Luckily, optics can support this challenge.

Sun light and white light

The Sun is Earth's primary light source, and as human beings, we naturally evolved our vision to match the Sun's spectral emission. The Color Rendering Index is giving exactly 100 only under natural daylight, and CCTs are changing throughout the day. In the past, when Neon Light was used, there could be only a fixed CCT for the whole working day. The same tendency has been found in the initial moments of the LED.

Today, LEDs in multiple CCTs are available in the market, PCBs are relatively cost-effective, and control systems like DALI are well available and affordable. This allows for tuning white LEDs throughout the day. Starting from a CCT of around 2700K in the morning, the LEDs can rise in CCT up to 6500K during midday and drop back to around 2000K in the evening. It is one of the key features of or well-being: perceive the subtle changes in color, steady and constantly, and allow our body to feel the passage of time.

Optics must comply with perfect color-mixing ability, to allow Tunable White and a smooth passage between each color temperature. Only so, the illusion of being outside, while working

on a PC, can be created.

Glare – what to do?

Except if you look directly in to the Sun, it will naturally occur to you, that whatever is sunlight has absolutely no glare. That seems to be almost impossible if you think that at midday you have a staggering 100.000 lux around you: no luminaire is capable of doing it. Understanding however how nature works, will help us make better lights.

The Sun spreads over the sky and allows for very diffused illumination. Spreading its candlepower over a very big surface lowers the sky's luminance close to zero. The ideal source for an office must be low-glaring, and therefore cover the full ceiling and spread a lot of light, shouldn't it? This idea often clashes with design requirements, power supplies and other needs in the building. The trend for luminaires is then to go smaller and smaller in dimensions, which would actually increase luminance and therefore glare.

In this case as well, optics play huge roles, when complying to UGR as defined in EN 12464-1, which in its latest update also includes uniformity as a must. Optics should lower the luminance over angles of 65° to obtain the desired UGR of 19 in office spaces. Pushing the boundaries of a UGR of 16, a more comfortable office environment is created.

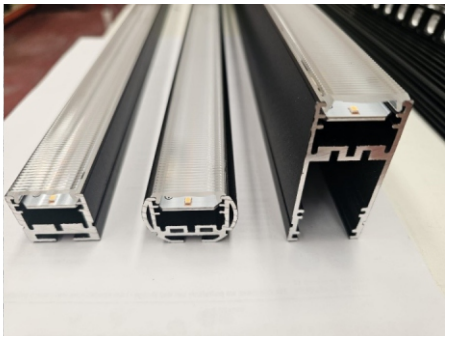
UGR and efficiency

One may think, that UGR is a direct enemy of energy efficiency: if we should reduce the luminance over the angles of 65°, then we have an immediate reference of spacing of luminaires, a direct amount of luminaires and an absolute power to drive them. Well, not quite.

It is true that luminance on angles above 65° should be lowered, so whatever luminaire should stay in a total beam width of 130° maximum. The real fact is that optics are working towards shaping the light in this 130° cone, allowing for powers and light to be modeled around the target areas, caring for max uniformity. As true as it is, that there is an UGR standard, so much is there a human perception and a complexity in every space. Scattering of light on surfaces brings greater value to uniformity and to well-being, that the sole UGR score. So whenever there is an efficiency problem, there is an efficiency solution: allow the designer to take leverage of the environment, its scattering properties and its materials. It will create the perfect efficiency balance.

Optics and Research

Khatod has long stayed in the optics business, to understand the impact of sunlight in office spaces and share this knowledge to everyone willing to participate in this vision: our core product for offices ANDROMEDA, includes the above 3 key concepts in a slim linear shape. Equipped with 14 optics, it allows space for up to 28 LEDs, has color mixing capabilities and strikes a perfect UGR 16 at 4.000 lm per meter – the highest on the market.



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