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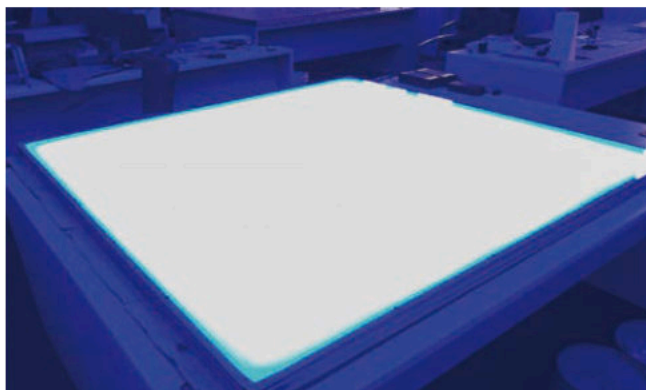
Seite 16 / 178

Perfect lighting quality

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Intelligent large-area LED lighting Perfect lighting quality

The reliability and flexibility of vision applications are always directly linked to the installed lighting quality and its intelligent control. Optimised illumination under changing conditions is extremely important.



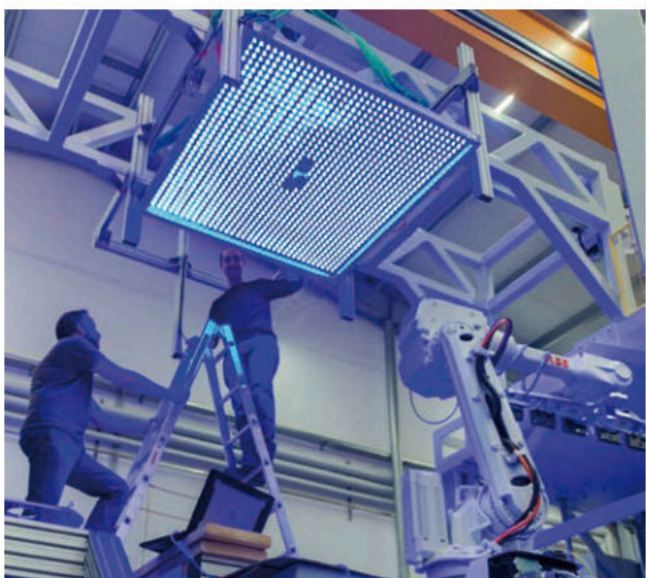
The borderless, large-area, optimised uniformity of the lighting module makes a decisive contribution to effective detection and absolute reliability in vision solutions.

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In industrial machine vision, large inspection objects require much more extensive lighting know-how in hardware and software. For small parts, measures such as enclosures or high light intensity make it much easier to prevent external influences, including daylight.



Homogeneous light from a 1,500 × 1,500 mm LED light enables precise inspection of adhesive application on an automotive parcel shelf, with a reliable detection resolution of 0.3 mm.

For large parts or extensive inspection areas, a conventional approach would involve considerable effort and would severely restrict the flexibility to inspect different large components. The solution to such demanding machine-vision applications is a combination of powerful LED lighting systems and intelligent, versatile light control.

Homogeneous illumination over large areas

For large parts or extensive inspection fields, Cretec offers a broad portfolio of large-area, modular, intelligently controlled LED lighting systems. Available in variable and custom sizes, these modules range from borderless backlighting to homogeneous reflected-light illumination. They provide economically and technologically efficient vision solutions even for very complex requirements in fully automated quality control. Besides application-specific optimised lighting, the company offers complete vision solutions, from feasibility studies and installation to reliable support.

Lighting inspection objects correctly

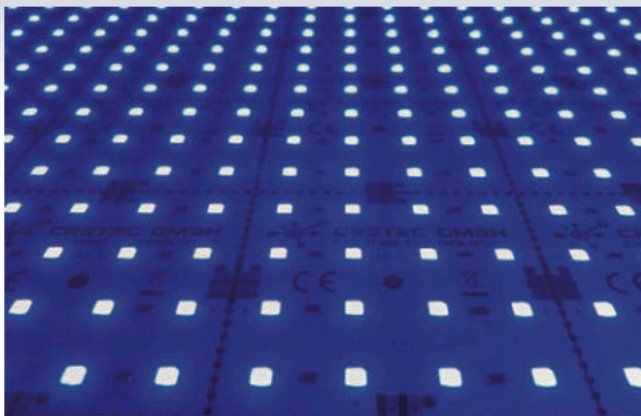
Inspection objects must be illuminated so that critical features can be detected precisely and with clear contrast. This requires lighting expertise and application experience: how light travels from the source to the object, is reflected or scattered by it, and finally passes through the lens to be captured as a high-quality image by the camera sensor.

As in professional

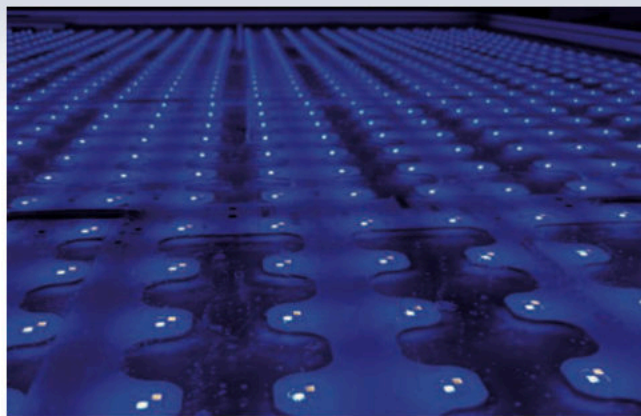
photography, illumination is assessed in terms of luminance, which describes the brightness of light from emitting surfaces. This approach precisely describes homogeneous light emission over the entire illuminated area. It is particularly important for difficult objects whose shape and reflective properties impose special demands. For example, high-intensity applications involving fast-moving objects on production lines must avoid overexposure at the centre of the object. Maximum borderless uniformity is essential for consistent results in a vision application.

A broad spectral range for feature extraction

The lighting modules are designed for industrial use, including harsh environmental conditions and hygienic requirements: exactly the right light for each application. LED base modules can be combined into arbitrary geometric formats, including bar lighting for conveyor applications and large-area illumination. Available illuminated areas range from 50 × 50 mm to 6,000 × 6,000 mm. Base modules support all light colours in continuous or strobe operation. The LED boards are developed in-house and populated with white, red, green, blue, IR, UV, RGB or RGBW LEDs. In backlight modules, the spacing between the dimmable LEDs and their distance from the cover - a special diffuser - are selected to produce an optimised, borderless, homogeneous lighting field. Openings for optics can be incorporated where required.



The spacing between the dimmable LEDs and their distance from the special diffuser cover are selected to ensure an optimised, homogeneous lighting field.



Large-area lighting modules with four-colour LEDs offer an exceptionally wide range of machine-vision uses in strobe, colour-changing or daylight mode.

This allows the camera to sit behind the light and look through it. The large-area LED lights are factory-calibrated and require no further manual adjustment when the application changes. Growing demand for large-area lighting spans many industries, including automotive production, surface and coating technology, large inspection areas in packaging, and integration along wide conveyors in automated food production.

Protection rating

Lights and connectors are rated at least IP65 for water jets, optionally up to IP67 for immersion. An opening for the lens and camera is located in the centre of the light. Application-specific hygienic designs are also available.

Versatile intelligent light control

For each application, external control of the LED modules gives users a broad range of individual adjustments. For example, separating grey-level brightness values can improve contrast when imaging multicoloured inspection objects. Intelligent control of coloured LED light (RGB/RGBW) and image processing using tone mapping can substantially improve the reliable recognition of structures in many cases.

Four-colour LEDs

Four-colour LEDs allow

several different colour exposures of a product in succession, enabling precise detection of complex product features with just one camera. Homogeneous large-area lighting is also important for minimising the negative effects of reflective surfaces. The configured lighting parameters for product variants are stored as ready-to-use recipes in the vision software. White-light operation with controllable colour temperature opens further application areas.

Strobe mode

Operating LEDs in strobe mode offers many advantages in demanding vision tasks. Synchronisation in the microsecond range effectively freezes inspection objects, capturing them with high image sharpness. Compared with continuous light at larger aperture values and possible associated image noise, strobe lighting permits smaller aperture values with greater sharpness. A very short flash duration readily enables operation at 300% higher nominal current, greatly increasing the available illuminance. External environmental influences such as ambient light are also largely eliminated.

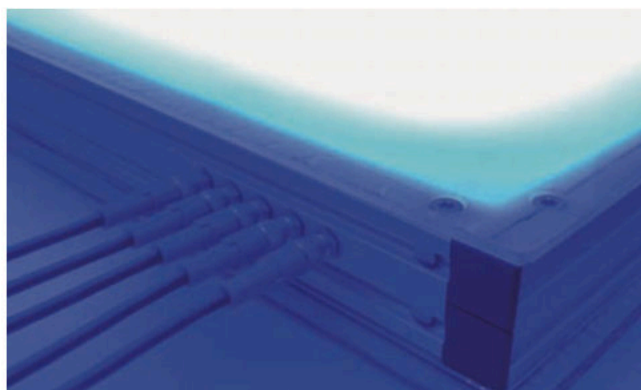
LED light intensity changes over the lifetime of the light or with temperature. These changes can already be taken into account and compensated by the control system. Cretec provides a five-year warranty on the lighting modules. This supports sustainability and

improves operational and investment security, leading to a better return on investment. Unnecessary production interruptions thus become a thing of the past.

Perfect adhesive bonds

In the automotive industry, there is growing demand to use machine vision for precise, automated surface-defect inspection of many different large interior trim and installation components. This is essential for subsequent fault-free assembly. The application required reliable handling of flat needle-punched nonwovens and carpets measuring from 250 × 250 mm to 1,400 × 1,300 mm, and precise vision inspection of transparent adhesive application. This had to account for rough material surfaces and different component colours: white, black, grey and brown.

The size and material

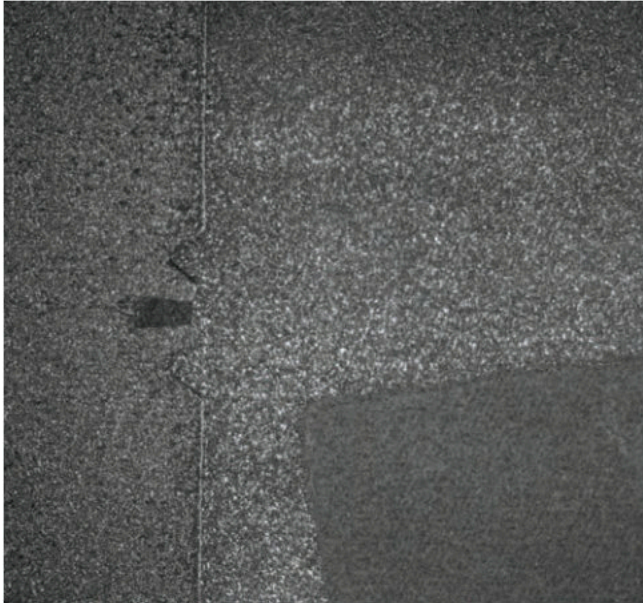


Depending on module size, power and external light control are supplied via several four-pin M8 connectors rated IP65 to IP67.

properties place very high demands on both machine vision and the optimised lighting needed for reliable detection. Robots handle the large-area parts, and the large field of view requires a camera working distance of 2.75 m.

Parcel shelf example

For example, a parcel shelf must be inspected fully automatically for completeness and correct adhesive application during three-shift operation, ensuring precise subsequent assembly. The position of the component is also measured accurately and passed to a second robot. A support component is then picked up, positioned on the parcel shelf and joined precisely. Cretec solved this complex, highly flexible task for different component variants with a complete machine-vision system solution.



The vision system captures defective adhesive application in great detail, with a measurement resolution down to 0.3 mm.

A key factor was a large-area, homogeneous blue LED lighting system using a short wavelength of 470 nm (dark blue). This allows good differentiation between white, black, grey and brown parts and minimises environmental influences such as daylight and factory lighting. These LEDs also offer high efficiency, and the short-wavelength light provides significantly greater depth of field in camera imaging. The light is only 45 mm high, measures 1,500 x 1,500 mm and has a 25-megapixel camera installed in the centre. External control directly addresses the LED base modules segment by segment, achieving optimum lighting uniformity and intensity.

Robots precisely position the adhesive-coated parcel shelves in the camera's imaging field. The system then detects whether the partly transparent adhesive has been applied uniformly across the entire component, with a resolution of 0.3 mm.

Technical data of the LED light optimised for this application:

- Supply voltage: 24 V DC
- Current consumption: 60 A
- Power consumption: 1,440

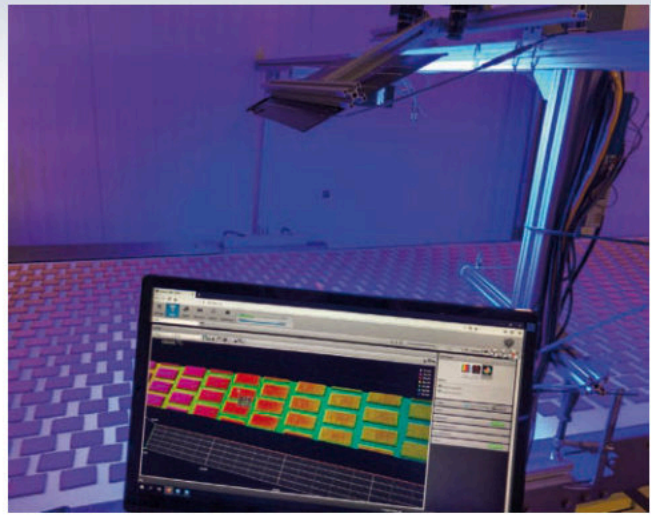
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- LED wavelength: 470 nm (blue)
- Number of LEDs: 12,480
- Power and external control via several waterproof M8 connectors.

This provides approximately 32,000 lumens at the inspection object.

Enjoyment in the best quality

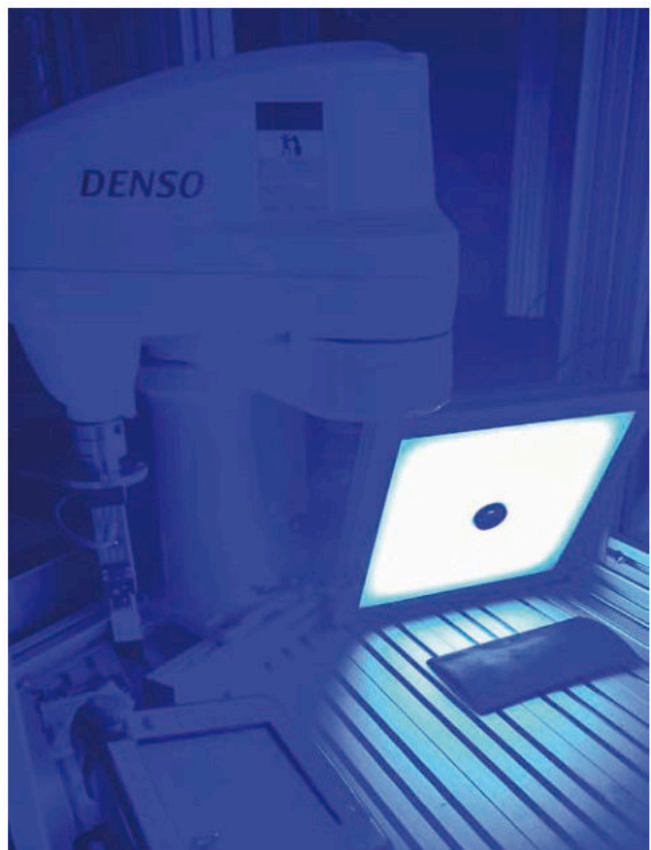
Correct lighting is also extremely important in biscuit production. Enjoying delicious biscuits is an experience involving all the senses: hearing, taste, smell and even the eyes contribute. All these requirements must be met. Fully automated biscuit production on a continuously moving, wide conveyor is a complex process with many necessary inspection functions. Everything must already run accurately on the conveyor. Without touching them, the system checks biscuits for overlap, joined pieces, incorrect alignment and more. Many additional features identify defects in individual biscuits at a throughput of several thousand per minute. Powerful industrial machine vision, in the hygienic design required by each application, ensures smooth production at



When designing the complex vision solution for biscuit production, all relevant inspection functions are identified. In the final system, a hygienically enclosed lighting module provided the same illumination characteristics.

the highest quality. Enclosed lighting modules providing absolutely homogeneous light across the entire conveyor width - for example 1.5 m -

form the basis for extremely precise, reliable machine vision.



Automated surface inspection is also available in combination with a collaborative robot, in a complete, mobile, compact station measuring only 0.8 x 0.8 x 2 m, including a precisely designed lighting option. Cretec GmbH also contributes extensive experience in linking systems to each industry's specific business communications, in line with Industry 4.0.