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High-quality illumination for large inspection objects

Historical technical statements, author details and 2019 performance claims are retained, including the original aperture / sharpness wording and the claim of a rated current 300% higher. Original images and credits are preserved. Original publisher artwork, logos and advertisements are retained in their original language.

Intelligent LED lighting systems

High-quality illumination for large inspection objects

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Homogeneity extending to the edges across a large-area lighting module is crucial for reliable detection and dependable vision solutions.

The operational reliability and flexibility of vision applications are always directly linked to the quality of the installed lighting and its control. Appropriate illumination under changing conditions is extremely important. A solution for demanding industrial machine-vision applications therefore combines powerful LED lighting systems with intelligent light control.

The modules are designed for industrial use, including harsh environments and hygienic requirements. The basic LED modules can be combined into any geometric format, as bar lights for conveyor applications or as large-area lights. Available illuminated areas range from 50 × 50 mm to 6,000 × 6,000 mm. All light colours are available in continuous or strobe mode. The LED boards are developed in-house and fitted with white, red, green, blue, infrared, ultraviolet, RGB or RGBW LEDs.

In the backlighting module, the spacing between the dimmable LEDs and their distance from the cover - a special diffuser - are selected to create an optimised, homogeneous illuminated field extending to the edges. Openings for optics can be incorporated where required, allowing a camera behind the light to look through it. The large-area LED lights are factory-adjusted and require no further manual adjustment when the application changes.

Growing demand for large lighting systems affects many sectors, including automotive, surface engineering and coating technology, larger inspection areas in packaging, and wide conveyor

belts in food production. The protection rating of lights and connectors is at least IP65 (water jets), optionally up to IP67 (temporary immersion). The camera opening is located in the centre of the light. A hygienic design is also available as an option.

Intelligent control of LED modules

For each application, users can make a broad range of individual adjustments through external control of the LED modules. Multicoloured test objects can be imaged with greater contrast by separating brightness values in the greyscale image. Intelligent control of coloured LED light (RGB/RGBW), combined with image processing using tone mapping, can considerably improve reliable recognition of structures. Four-colour LEDs allow successive exposures of a product in different colours, precisely detecting complex product features with just one camera.

All lighting parameters for product variants are stored as ready-to-use recipes in the vision software. White light with a controllable colour temperature opens up further application areas.

Operating LEDs in strobe mode offers many

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advantages for demanding vision tasks. Synchronised in the microsecond range, the light effectively freezes test objects and captures them with high image sharpness. Compared with continuous light at larger aperture values, potentially accompanied by image noise, strobe lighting can use smaller aperture values with greater sharpness. An extremely short flash duration permits operation at a rated current 300% higher, enormously increasing the available illuminance. External influences such as ambient light are also largely eliminated. Changes in LED light intensity over the

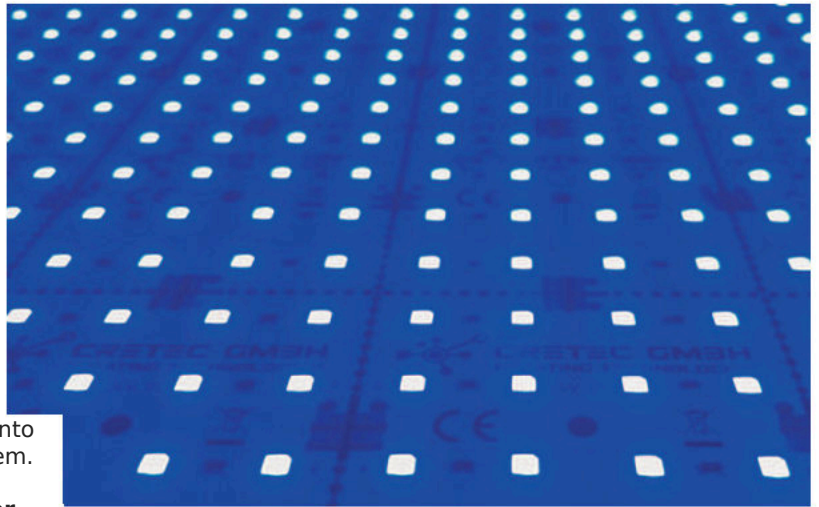
service life or with temperature can be taken into account and compensated by the control system.

Robot and vision system working together

The automotive industry increasingly requires precise, automated machine-vision inspection of the many different trim and fitted components used in vehicle interiors. This is the prerequisite for subsequent error-free assembly. This application requires reliable handling and vision-based inspection of flat needle-punched nonwoven materials and carpets measuring from 250 × 250 mm to 1,400 × 1,300 mm, taking into account difficult surface properties and the various component colours: white, black, grey and brown.

The dimensions and material properties place very

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The spacing between the dimmable LEDs and their distance from the cover - a special diffuser - are selected to ensure a homogeneous illuminated field.

high demands on both machine vision and the lighting system. Robots handle the large components, and the large field of view requires a camera working distance of 2.75 m. For example, a rear parcel shelf must be inspected fully automatically in three-shift operation for completeness and precise adhesive application, ensuring accurate subsequent assembly. The system also measures the component's position precisely and passes the data to a second robot, which then picks up a carrier part, positions it on the parcel shelf and joins the parts.

A large-area blue LED lighting system, 45 mm high and measuring 1,500 × 1,500 mm, with a 25-megapixel camera installed in its centre, was crucial to Cretec's vision-system design. External control directly addresses all basic LED modules by segment, achieving the required illumination homogeneity and intensity. A robot positions the adhesive-coated parcel shelves precisely in the camera's field of view. Uniform adhesive application across the entire component is detected at a resolution of 0.3 mm.

The blue LED light used for this application has the following technical specifications: 24 V DC supply voltage, 60 A current consumption, 1,440 W power consumption, 470 nm LED wavelength (blue), 12,480 LEDs, and power supply and external control through several watertight M8 connectors. It provides a luminous flux of approximately 32,000 lumens at the test object.

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

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Direct link to the market overview: www.i-need.de/f/64531