Technical Report – Vision sensors

Flash controllers and vision sensors – bringing together two worlds

Every application in image processing calls for proper lighting to create a process-safe solution through interaction with the appropriate hardware and software. Flash lighting is often indispensable to obtaining well illuminated, sharp images. External lighting solutions use their own flash controllers to do this. In addition to extra hardware costs, these devices require separate configuration, wiring and synchronization with the acquired image. By integrating the flash controller into a vision sensor with C-Mount connection, the expenses for system integration can be reduced significantly, saving as much as several hundred dollars.

Illumination is essential for applications in industrial image processing. Insufficient illumination will impede even high-performance software from providing a process-safe solution. Conversely, numerous tasks are easily mastered once appropriate illumination has been found. In recent years, LED illumination has become the standard in image processing thanks to an excellent price-performance ratio, long life and robustness where vibration and dust are present. But LEDs offer yet another advantage in comparison to alternative illumination solutions such as halogen and fluorescent lamps. Due to their short response time, LEDs can be activated in a time-synchronous manner when the image is being acquired and without damage to the components by repeated power cycles. On the contrary, turning the LEDs off between image acquisitions counteracts increasing temperature and will extend the service life. There are two negative conseuqences if the LEDs heat up: First, an increasing risk of damage to the illumination; and second, a risk of decreased illumination intensity. Red LEDs, for instance, radiate approx. 1 % less light for each degree Kelvin increase in operating temperature. In addition to extended service life, these short reaction times provide an even greater potential benefit. For brief periods of time, LEDs may be operated at higher power than possible during continuous operation. Consequently, illumination intensity can be significantly higher for the time of operation. This is also referred to as “flashed illumination”. Some illumination systems will allow an intensity increased by a factor of ten compared with continuous operation! Fast applications will particularly benefit, as often very short exposure times are used in order to

Test object acquired with a ring light as continuous light (left) and flashed (right) with otherwise identical acquisition settings.

	Continuous Lighting	Flashed Illumination
Benefit	Easy integration	Higher light intensity Shorter exposure times Longer useful life
Downside	Lower light intensity	Operator may be affected

Table 1: Comparison of continuous lighting vs. flashed illumination.

keep motion blur as limited as possible. However, a very bright image requires as much light as possible for the time of exposure. Flashed illumination is therefore most often the easiest and most cost-effective solution. Reduced motion blur is not the only advantage of proper illumination. A complete encasement and resultant shading of the camera system is sometimes infeasible, unintended or simply too expensive. Lack of such encasement will result in a higher risk of ambient light interfering with the image. Increased illumination intensity will reduce the ambient light impact since the correlated ratio of intended illumination to ambient light will increase.

Flash controller required

Flashed LED lights offer many advantages compared to continuous lighting (see table 1). However, flashed illumination is impossible without a flash controller. This external device ensures illumination by an electric pulse at proper intensity and duration and with the correct duty cycle (ratio of pulse duration to pulse period). However, controller configuration is quite an effort because manufacturer-specific programming environments are typically used. RS232 interface is still very common but not supported by many recent PCs and laptops. In addition, the controller has to be synchronized with the camera›s image acquisition or with the vision sensor. Wouldn›t it be easier if the necessary functionality were just a few mouse clicks away? Electrical installation may also present major obstacles. While conventional machine supply is 24 VDC, numerous illumination systems operate on 12 VDC. Therefore, the ability to adjust voltage or even to install a separate power supply is indispensable. Furthermore, electric installation entails quite an effort to wire and connect many different cables. While standards have been established elsewhere, there is no standardized interface for illumination modules. Illumination set up and installation can therefore be surprisingly complex.

Direct connection of the illumination to a *VeriSens*® XC series via 4-pin M8 connector.

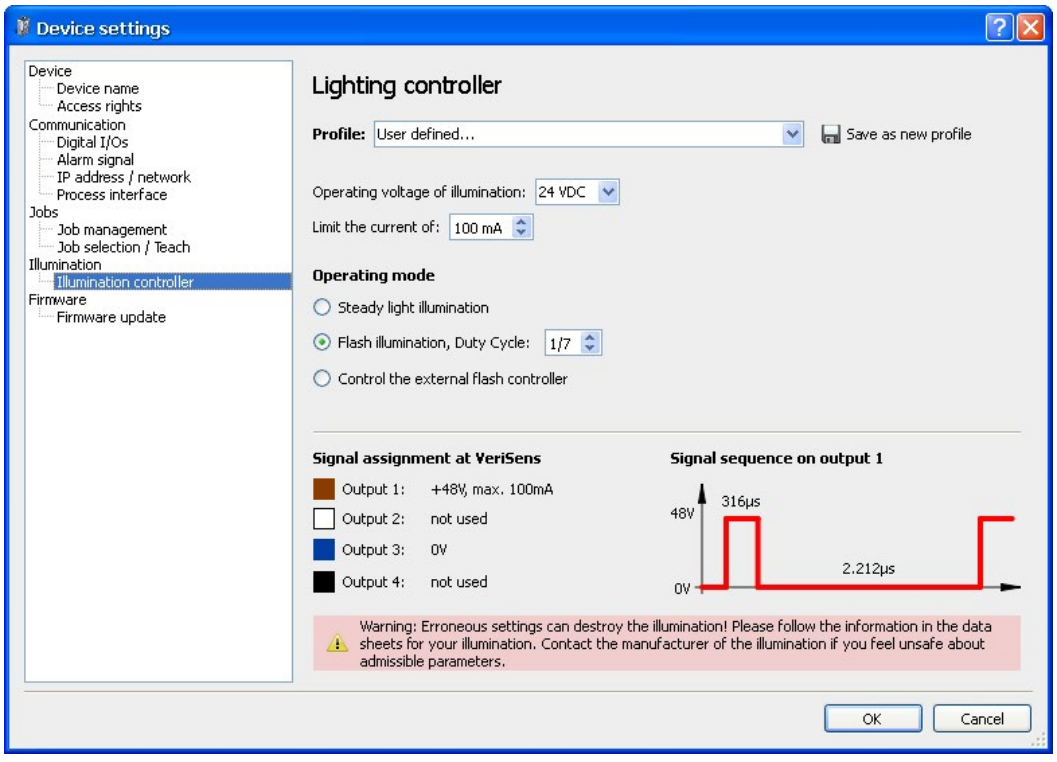
Integrated flash controller for simpler set-up

In recent years, vision sensors without extensive configuration have proved capable of many tasks in image processing. Vision sensors are gradually finding their way to applications that in the past were reserved for complex image processing systems. The primary reason is that a single compact device is now capable of incorporating a complete image processing system. With the new *VeriSens*® Vision Sensors with C-mount connections Baumer is now one step ahead: These sensors have a flash controller integrated in both hardware and software and therefore provide substantial benefits to the user. Additional configuration and cabling effort are no longer required, and synchronization between image acquisition and flash impulse is now greatly simplified and therefore saves valuable time during set-up. The controller is configured and programmed via the vision sensor›s user-friendly operating software. The necessary illumination parameters can be adjusted with a few mouse clicks which provide a high level of flexibility when choosing the illumination.

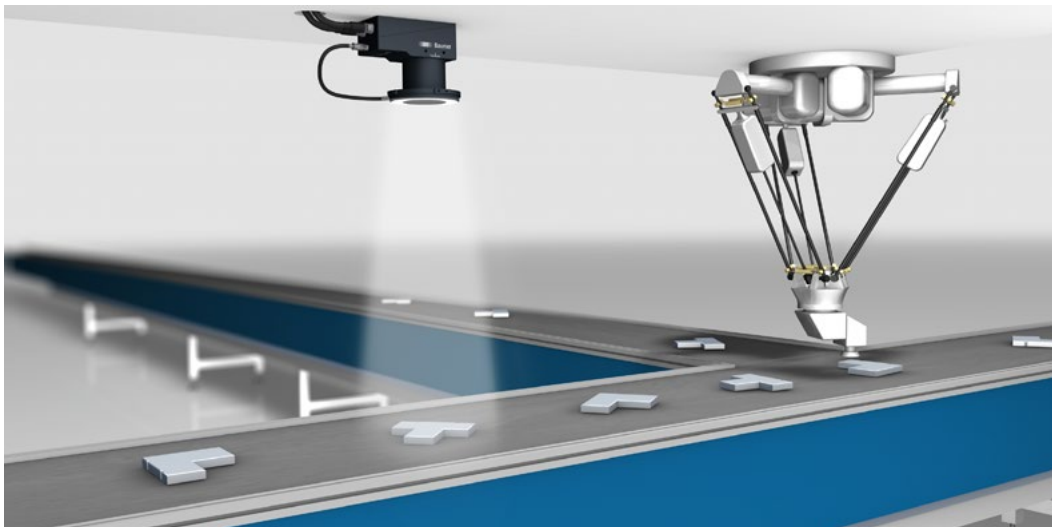
The new *VeriSens*® XC series with integrated flash controller.

Standardized illumination connection

Another hallmark of the vision sensor is the connector designed for illumination-specific connection requirements: The standardized 4-pin connector (M8) is capable of numerous illumination connections. Adapter cables are available for other illumination systems or additional external flash controllers, for example to allow connection via JST connectors that are mainly used by manufacturers such as ccs or Falcon. As mentioned above, the controller›s electrical parameters can be configured via the software with voltage and maximum current selection (continuous lighting: 12 / 24 VDC, max. 800 mA, flashed illumination: 24 / 48 VDC, max. 4 A peak).



Configuration dialog of the *VeriSens*® XC series integrated illumination controller.



The integrated flash controller of *VeriSens*® C-mount ensures excellent lighting even at large working distances.

A vision sensor with flash controller

Since the flash controller is integrated into the *VeriSens*® C-Mount, set-up of external illumination becomes child's play. Flashed illumination with all its benefits such as extended service life, improved light yield, reduced ambient light impact and decreased motion blur is as easily integrated as continuous lighting. You save time, installation space and last but not least the separate flash controller itself. The necessary parameters can be configured during vision sensor set-up within the sensor software, without any separate configuration tool. The user is therefore able to focus on the essential: A quickly available and efficient solution for the application!

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