Multi-Channel Flash Feature

For

allPIXA pro, allPIXA wave

and

allPIXA evo cameras

Multi-channel flash feature:

The allPIXA pro, allPIXA wave and allPIXA evo camera can be used to trigger up to four different flash controller channels synchronized to its line acquisition. This can be used to acquire several images with different illumination geometries (dark field, bright field, or backlight, co-axial) and/or colors (white, red, green, UV, IR) simultaneously in only one scan by line-multiplexing. This means multi-channel flashing of allPIXA pro, allPIXA wave and allPIXA evo camera (allPIXA series) enables the system to scan the object using with up to four different type of illuminations in a single scan. Please refer to below figure for illustration.

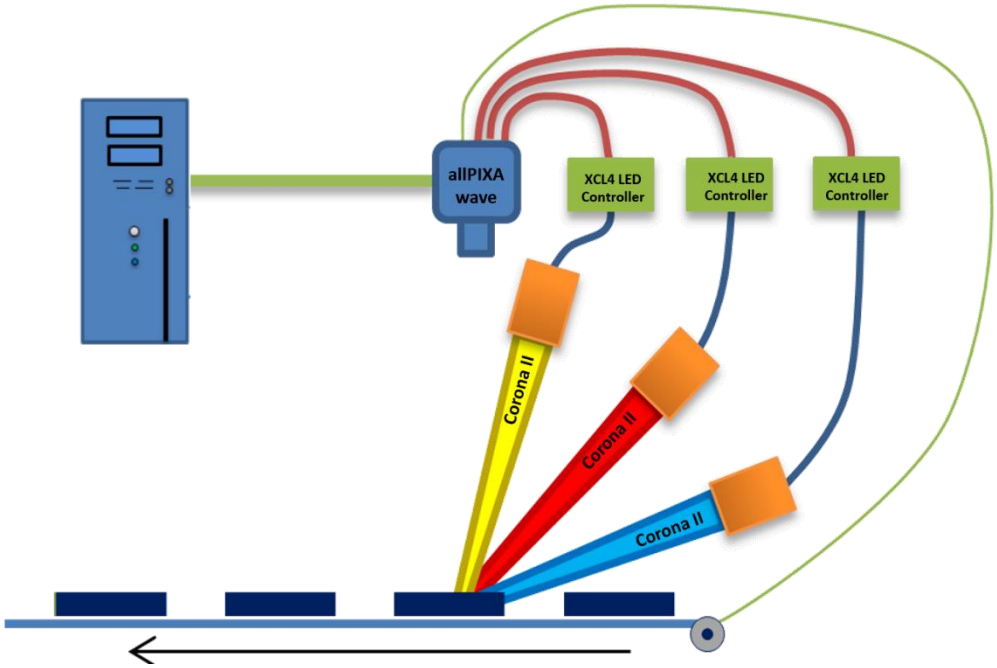

Figure 1: Schematic set up

Various types of defects that are possible to be captured with this kind of vision system. Examples are cracks, scratches, stains, chipping, foreign particles etc. The set up can be very effectively used for applications like wafer inspection, AOI / PCB inspection, LCD panel inspection, glass inspection, security print inspection, BGA, semiconductor inspection and various similar applications.

Multiple acquisitions within a single scan with a single camera will save time and money. The multi-channel flash control feature of allPIXA pro, allPIXA wave and allPIXA evo can acquire multiple images, whereas every image is recorded under different illumination conditions in a single scan. In addition, high color fidelity and a high dynamic range help to achieve excellent results in defect detection. The high-quality color images can give more information about the defect class and extent of the defects on the object. Combining the multiple illumination in single scan gives inspection system an advantage to overcome the challenges of shiny surface of the object. Further, the large full well capacity of the sensor enables a high dynamic range and the blooming resistance is outstanding, which is very import for strong local reflections in bright field configuration.

Flash controller synchronization:

One application where this is useful is in inspection tasks where different kinds of defects are identified either in images captured with brightfield illumination (e.g. scratches) while other defects require darkfield illumination (e.g. dust particles). Figure 2 illustrates this concept: The left side shows the raw camera image output for a metal sample with activated flash mode for one brightfield and one darkfield illumination. The size of this image in scan direction is enlarged by a factor of two as each line is captured twice with alternating illumination. The result is an image that is interlaced line by line repeatedly. This image needs to be deinterlaced and a correction for the color plane shift needs to be applied (see below for details) which results in the images shown on the right. The separation of these images is not part of the camera function and needs to be done in a postprocessing step.

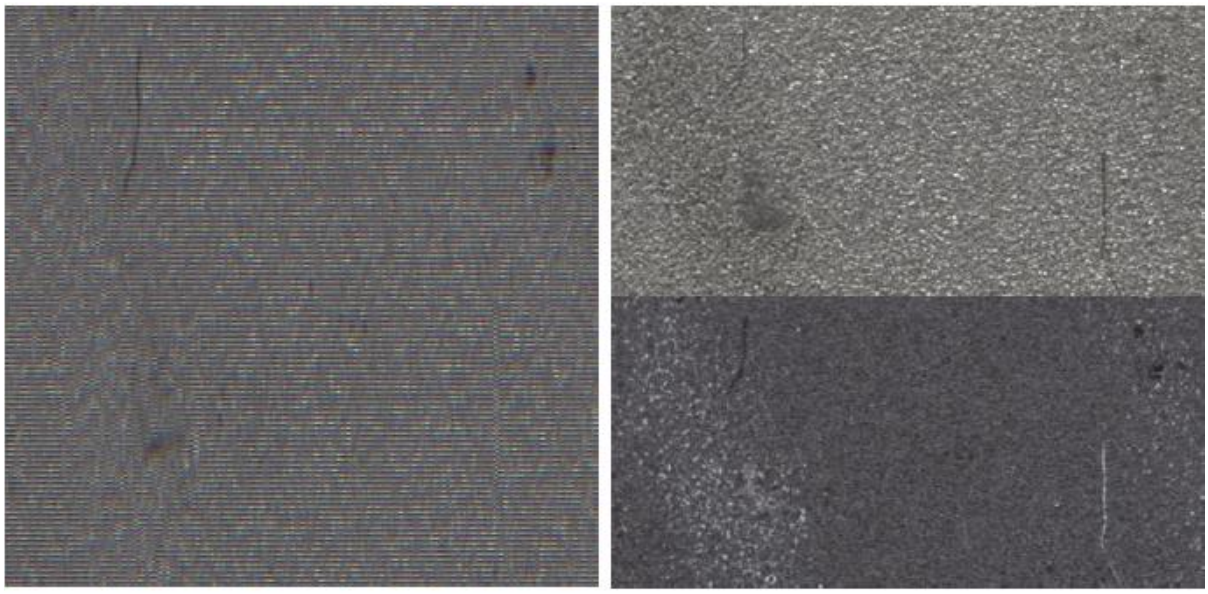

Figure 2: Flash mode acquisition of metal sample with two different illumination geometries.
Left: raw camera output
Right: Separated individual images with color plane correction

The flashing can also be done using color illuminations which would lead to separated images with the maximum intensity concentrated in one of the color channels. Please note that for an RGB camera each of the separated images will nevertheless consist of all three color planes. Extracting the color plane with maximum intensity also needs to be done in post-processing.

Configuring a flash pattern sequence:

The flash control of the camera can trigger not only one but any number of its four outputs for each flash line. The definition of which outputs are active for how long at each line is called a flash pattern. The flash control set up by two to four patterns which are executed repeatedly one after another. The flash set up and sequence parameters can be easily set up using Chromasens Camera Set up Tool (CST) or GCT in the case of allPIXA evo.

Using flash mode for multi-exposure / HDR imaging:

The flash mode of the allPIXA pro, allPIXA wave and allPIXA evo cameras allows to capture multi-exposure images during a single scan. This results in several congruent images of the same scene with different integration times. Such a set of images is the prerequisite needed to compose a single high-dynamic-range (HDR) image. The general goal of HDR imaging is to reduce the loss of detail from imaging scenes containing regions with vastly different brightness. With a single image, one can either use a low integration time which loses information in the dark regions due to camera noise or a higher integration time which leads to saturation in the bright regions. But if the images from both (or more) exposure times are available it is possible to optimally compress this information into the standard dynamic range of a digital image.

How the flash mode can be used to capture these congruent images of different exposure times. The flash mode of the allPIXA series cameras is implemented in such a way that the integration time during each pattern is determined by the resulting time of the pattern which is shown below each pattern column. So, for HDR imaging set up the flash patterns in such a way that the resulting times of the patterns matches the needed different exposure times. But then do not connect the flash outputs of the camera to the illumination controller and keep the illumination constantly switched on instead. This will create an interlaced image like the one shown in Figure 2 but with different exposure times instead of different illumination geometries.

Figure 3 demonstrates it using a ball grid array (BGA) sample. The solder balls are made of highly reflective metal while the base of the sample is usually quite dark. The HDR approach allows to inspect the base for defects (e.g. scratches) without saturating the balls. There exist multiple ways of computing HDR images from multiple low-dynamic range images.

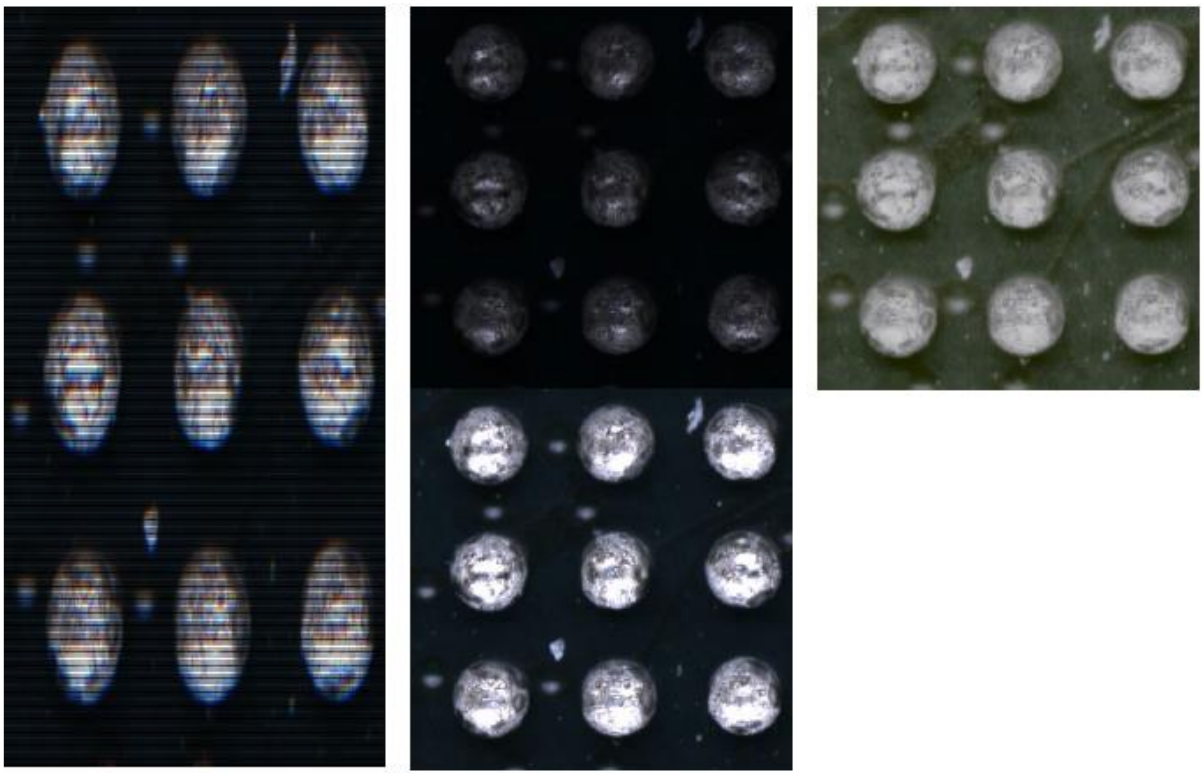

Figure 3: HDR demonstration on ball grid array sample
Left: Interlaced image
Middle: Separated images with different exposure times
Right: HDR image

Flashing an XLC4:

Any flash controller that is compatible to the electrical and timing specifications of the camera output interface can be synchronized with an allPIXA pro / allPIXA wave camera. To ensure compatibility it is recommended to use the Chromasens illumination controller XLC4.

Multi-channel flash feature for 3D PIXA and master/ slave cameras:

he master slave mode for allPIXA series of cameras is two or more cameras are synchronised in such a way that each line is captured at exactly same moment in both or more cameras. In this mode, one of the cameras is the master which receives the encoder signal and controls other cameras.

Multi-channel Flash mode is fully compatible with master / slave operation of the allPIXA series of cameras, 3D PIXA cameras. It is strongly recommended to use a dedicated frame trigger (no endless mode). For a 3DPIXA with internal master/slave interface (CP000520-XXX, CP000600-XXX) you can send the trigger signals to the camera using the Camera Link signals as this will free up the external interface for flashing. Otherwise the external interface is already in use for the synchronization cable so to access the pins sending the flash signals you need a suitable breakout cable.

About Chromasens:

Chromasens GmbH, Germany is TKH group Company offering full range of high speed color and monochorm line scan cameras and high intensity homogeneous illumination solutions. Chromasens also specializes in 3D technology an colour measurement cameras based on line scan princple. Chromasens has also develops and offers wide range of OEM complete vision solutions for various machine vision applications. For more details www.chromasens.de

Chromasens GmbH
Max-Stromeyer-Straße 116
78467 Constance
Germany

Phone: +49 (0) 7531 876-0
Email: sales@chromasens.de