

Contact Image Sensor Simplifies Packaging Inspection Techniques

Using contact image sensor (CIS) technology for flexible packaging inspection applications



Sustainability has become a key focus across nearly all industries and verticals. As such, companies are becoming consciously aware of the environmental impact and carbon footprint of both the products themselves and the subsequent packaging used for distribution. Flexible packaging, in particular, is a newfound sustainable manufacturing technique that's predicated

around two fundamental principles: cost-efficiency and sustainability. The versatility, efficiency, and minimal carbon footprint of flexible packaging is perfect for forward-thinking organizations seeking sustainable distribution solutions. Contact image sensor (CIS) technology can improve the flexible packing inspection process by identifying package defects, improving manufacturing efficiencies, and reducing material waste.

CIS is perfect for flexible packaging because it's created using web-based processes. The CIS technology can be used for inspection applications to ensure package material quality and product integrity is up to par. Although CIS applications have been in existence since the creation of fax machines, manufacturers and integrators are now increasingly utilizing CIS to improve line scan applications.

Traditional packaging facilities have long used optical reduction systems that require multiple cameras, lens, brackets, and complicated calibration procedures. CIS technology, on the other hand, uses single camera technologies that create sustainable production techniques to enhance packaging integrity and efficiency. Higher image quality produced by CIS can improve inspection systems which in turn helps produce more efficient packaging and manufacturing techniques.

The Challenges of Optical Reduction Systems

Distribution and manufacturing facilities have traditionally used optical reduction systems for all of their packaging needs. The complexity of these optical reduction systems require the use of multiple cameras, lenses, brackets, and calibration procedures for wide field of view applications. A single one-meter web often uses two or three camera systems which can make it difficult to develop repeatable, accurate, and automated solutions.

Optical reduction systems produce image distortions at the ends of the field of view due to variations in working distance between the object and imaging sensor. The result is manufacturing inefficiencies that create high waste outputs, low production speeds, and long changeover times.

The manufacturing processes associated with flexible packaging tend to be highly inefficient when relying upon traditional optical reduction systems. These out-of-date technologies have a large depth of focus (over 4 mm) and long optical path (300-1000mm) which distorts the ends of field of view due to variations in working distance between the object and imaging sensor. Due to this, optical reduction system infrastructures necessitate a larger manufacturing footprint with greater spacing requirements.

Flexible packaging manufacturers that use optical reduction system processes can be particularly challenging to inspect when it comes to quality and control. However, deploying CIS line scan imaging applications can simplify flexible packaging inspections.

Using CIS for Packaging Inspection Applications

CIS technology can enhance flexible packaging processes, in turn helping to improve the manufacturing and production quality of items such as bags and pouches produced by form-seal-fill equipment, as well as shrink films, tubes, sleeves, and carded packaging. Each of these items are produced using web-based processes with materials such as paper, plastic, film, and aluminum foil – making them ideal for CIS line scan inspection applications. CIS can also verify variable data found on packaging such as lot-codes, barcodes, labels, and more.

The KD Series CIS from Mitsubishi Electric uses LineScanBar™ technology with a highly compact design that can be applied to both new and existing production lines. Its singular modular housing requires minimal space and provides elements of modern vision systems. The LineScanBar comes with an illumination system, a lens, and a sensor housed within a compact design. Maintenance is simplified as modules can be exchanged within minutes.

The rod lens technology provides high image quality and 1:1 scaling created by a graded index rod lens array. Telecentric viewing angles also help to create distortion-free images, resulting in precise measurements. The pixel size is 42 mm x 42 mm, which results in true 600 dpi. Equipped with the trilinear CMOS sensor and RGB filters, the Mitsubishi Electric LineScanBar ensures high color fidelity. Image acquisition speed is achieved using optimally aligned integrated white LED illumination and integrated binning. The resolution is adjustable from 150 dpi to 600 dpi with or without the integrated illumination system.

The KD Series CIS utilizes repeatable and reliable machine vision systems that acquire undistorted images with sharp edge transitions. This helps to ensure substrate integrity while detecting any holes and tears during the flexible packaging manufacturing process. Furthermore, machine controls provide real-time quality and production data, helping to improve packaging efficiency. The optimization and digitalization of the flexible packaging manufacturing process can help companies create sustainable products with less waste and higher efficiency rates than traditional optical reduction systems. As a result, CIS technology can drastically improve material quality and integrity, in turn simplifying flexible packaging inspection techniques.

Improving Material Quality and Integrity

CIS machine vision technology will consistently ensure packaging quality and integrity is upheld to the highest standard possible. The web-based processes used to create flexible packaging elements such as paper, plastic, film, and aluminum foil can be optimized using CIS line scan imaging technologies. Use CIS to seamlessly perform inspection applications that check package quality and integrity, review color registration of graphics, and verify variable data on labels such as barcodes, lot-codes, and label placements. CIS vision systems can prevent a number of potential manufacturing issues including the detection of holes in material and printing defects. The images acquired by a CIS are also of high-enough resolution to be used in vision systems for mark quality assessment, barcode grading, and lot verification.

The KD Series CIS integrates an array of sensor ICs, a rod lens array, and a light source housed within a compact image sensor module. The rod lens arrays' 1:1 imaging ratio creates less distortion than ordinary line scan camera systems, improving accuracy. The KD Series CIS captures images with higher resolution making it easier to detect small defects in the quality and control part of the production process. This improves the accuracy of inspection systems in flexible packaging assemblies as defects can be sorted prior to mass production and distribution.

The KD Series CIS includes two models, one with built-in illumination and one without illumination. The built-in illumination model's structure includes a lens array, light source, and sensor ICs. The non-illumination model provides the flexibility to use external light sources to achieve various light-source angles, settings, and transmitted light options. Both options come in various standard sizes to meet a variety of applications. For more detailed KD Series CIS model information and specifications, [download the datasheet](#).