



Optical Measuring Systems

CAMERA CLUSTER SYSTEMS (CCS)

Pinhole Detector

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PRODUCT QUALITY AT THE HIGHEST LEVEL

The tightness of material plays a critical role in your production and processing of tin or aluminium plate or foil for the packaging industry. Even the smallest of pinholes can cause foodstuffs to spoil quickly, containers or spray cans to leak or medicines to become unsaleable. The quality of your products must be of the highest order and irregularities during production must be detected and eliminated immediately.

The thinner plates and foils become during rolling, the higher the likelihood that pinholes ranging from a few micrometres to several millimetres in diameter will arise. A frequent cause of this is contamination of the metal during smelting or pouring as well as damage and soiling on work rolls. Later, during further processing, e.g. deep-drawing, pinholes can cause destruction of tools.

To achieve high quality standards, it is especially important to detect all pinholes or cracks in the material, no matter how small they are, at an early stage. Pinholes are not only a quality feature, they are also the reason for broken strips, particularly in the case of foils.

Very High Detection at Top Speeds

The pinhole detector newly developed by IMS for the metal industry has very many image sensors lined up next to each other in a camera housing. These sensors communicate with each other via a digital highway and exchange neighbourhood information.



There are 50 image sensors in a beam-shaped camera housing per metre measurement range. The “mini-cameras” are lined up next to each other with a gap of 20 mm in between. The field of vision of the cameras used for evaluation of the data lies near their optical axes, which means the defects can be detected optimally.

Measurement is based on detection of finest quantities of light by CMOS photosensors. Embedded data processing enables detection of pinholes at the highest of line speeds. The CCS pinhole detector detects, localises and classifies even the smallest of perforations reliably during the production of strip and foil. The basis of the system is formed by the globally unique, patented Camera Cluster Technology.



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Modular, Light, Compact – Installation in the Smallest Space

The space available in your production lines for measuring equipment is often limited. The system should therefore be *easy to install*, regardless of whether the strip is running horizontally or vertically. Later monitoring of measuring equipment must be easy to perform.

A gauge basically consists of two components – a camera unit beam and a backlight unit beam. Thanks to *modular construction*, it is possible to covering every strip width.

Another deciding pro:

The measuring beams can be fastened to existing parts of the line or on a fixed O-frame or mobile C-frame (with and without drive). The distance to the strip is independent of the strip width and can be implemented according to your requirements.

Long Service Life, Highest Precision in Adverse Conditions

The LED technology used in the backlight unit beams guarantees operation of the measuring systems over years without replacement of components. Optical filters *eliminate the influences of extraneous light almost completely*.

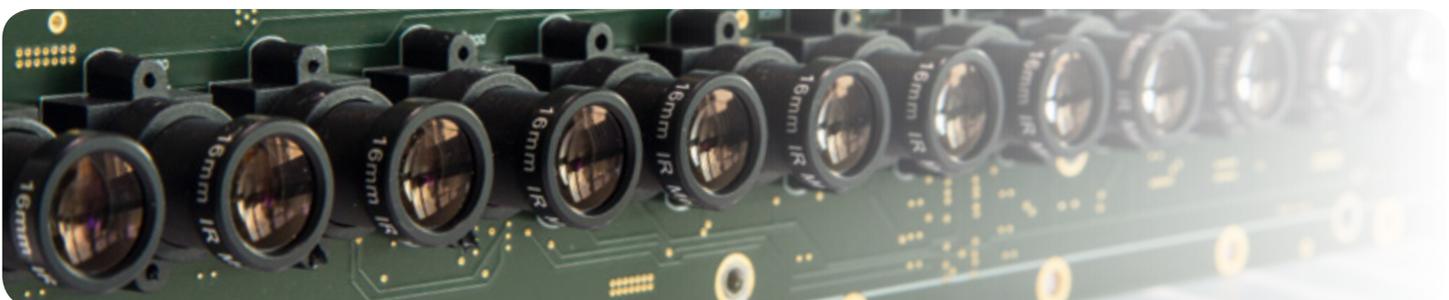
The measuring system is equipped with an automatic dirt

detection system that warns your operating personnel in good time before measuring errors occur. The intelligent backlight is equipped with an Ethernet interface; physical LED ageing processes are compensated. An air wipe system is deployed in difficult ambient conditions such as those found in rolling lines.

Mechanical Edge Blankout Was Yesterday

Due to interfering light influences in the edge area, other manufacturers use a mechanical edge blankout, which requires not only high maintenance, but is also susceptible to faults. The disadvantage of this solution for you lies in the fact that large areas of the edges are covered mechanically, with the result that pinholes in this area cannot be detected.

In our CCS pinhole detector the backlight consists of power LEDs. The light source is controlled specifically with the data from the integrated and intelligent strip edge tracking system. Mechanical blankout of the edges is not necessary. The strip is inspected to almost 100%. Our solution does not require maintenance costs.





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IMPORTANT DECISION CRITERIA:

How Others Approach the Problem:

One established method of hole detection is to illuminate strip from one side with line-shaped light sources and to detect the light shining through the holes with photo detectors. The previous state of the art was to use just a few detectors. The disadvantages of this arrangement are, however, that the position of the holes transversely to the direction of strip run could not be determined exactly and their size was difficult to ascertain. Further, holes lying close next to each other were not detected.

The Previous State of the Art: The Camera Concept from IMS

The cluster concept increases the resolution of the image immensely. Whereas traditional photo detectors only determine the position transversely to strip direction relatively roughly, the 50 cameras that are used over a strip width of 1,000 mm have ten thousands of pixels transversely to the direction of strip run.

With this *high resolution* it is possible firstly to determine the position of a hole transversely to the direction of movement extremely precisely. Since the results are synchronised with the strip speed, the *position of the holes* in strip length direction can also be determined exactly. Secondly, the new technology allows the holes to be classified by *size* for the first time.



- ✓ **Improvement in quality and reduction in edge cracks through detection of pinholes, holes and edge cracks**
- ✓ **Proof of your product quality for your customers**
- ✓ **Reliable detection, localisation and classification of even the smallest of perforations during the production**
- ✓ **Global unique, patented Camera Cluster Technology**
- ✓ **Exact localisation and categorisation of defects in longitudinal and transverse direction**
- ✓ **Installation in the smallest of spaces (horizontal and vertical installation position possible)**
- ✓ **Long service life and highest precision**

Holes in the area of the strip edges are a frequent cause of strip cracks. Exact information on defects help to avoid broken strips in mill stands and processing lines. Above all, however, data on the location and size of the holes found is interesting for subsequent processes.

A quality data management system such as MEVInet-Q from IMS can use the data automatically to decide on the further processing steps of the coil and, for example, optimise slitting or cross-cutting.



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Your Challenges:	Our Solution for You:
<input type="radio"/> High investment costs due to use of conventional camera systems	<input checked="" type="checkbox"/> Camera cluster systems use hundreds of mini cameras that can be deployed in measuring systems economically
<input type="radio"/> Measuring errors due to extraneous light influences	<input checked="" type="checkbox"/> Optical filters eliminate the influences of extraneous light almost completely
<input type="radio"/> High maintenance costs for replacement of the light sources	<input checked="" type="checkbox"/> High lifetime of the LED modules
<input type="radio"/> Mechanical edge blankouts susceptible to faults and high maintenance costs	<input checked="" type="checkbox"/> Thanks to intelligent strip edge tracking with control of the light source, it is possible to work without mechanical edge blankout
<input type="radio"/> Very small distance to the strip in the case of existing pinhole detectors High risk of damage	<input checked="" type="checkbox"/> The CCS pinhole detector is positioned significantly further away from the strip
<input type="radio"/> Physical ageing processes of light sources	<input checked="" type="checkbox"/> Intelligent light source with light intensity control
<input type="radio"/> Restricted space particularly in existing production lines	<input checked="" type="checkbox"/> Very compact and light design enables simple integration in existing production lines
<input type="radio"/> Failure of measuring equipment due to dirt	<input checked="" type="checkbox"/> Automatic dirt detection and warning Air wipe systems are implemented at locations where there is a high risk of soiling
<input type="radio"/> Unsatisfactory detectability of pinholes	<input checked="" type="checkbox"/> High sampling rates by embedded FPGA image processing Using small visual ranges per camera, the inspection area is close to the optical axis
<input type="radio"/> Material losses from large edge blankout (non-measurable part)	<input checked="" type="checkbox"/> Intelligent strip edge tracking with controllable LED light source enables very small edge blankout
<input type="radio"/> Unreliable detection of the size of pinholes	<input checked="" type="checkbox"/> Multiple classes for pinhole sizes Large holes are also detected



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Performance Data of the Pinhole Detector

Pinhole size	from 5 μm (in foils) ^{**1)} from 10 μm (in sheet) ^{**1)}
Edge blankout	3 mm from strip edge
Max. permissible strip height fluctuations	± 5 mm
Distance between material and camera unit	90 mm
Distance between material and backlight	110 mm
Strip width	not limited
Strip thickness	not limited
Strip speed	not limited

^{**1)} The detectable hole size depends on the strip thickness and strip speed. Exact details are specified on a system basis.