

Editorial



Volker Pape



Dr. Martin Heuser

Dear Readers,

The year 2011 is drawing to a close, yet the world is not really becoming more stable. As soon as one issue is resolved, new turbulences arise somewhere else. As a result, prediction and planning are only complicated.

In this context, Viscom is taking the straightest approach possible. With proven system technology on the one side, and high performance new developments on the other: these two pillars continue to form the basis of our product portfolio. Our 3-D SPI, delivered since the middle of this year, has become a genuine success. The Beta customers of vVision rate this product very positively. All developments are fully according to plan. As technological forerunner, Viscom is also as economically stable as ever; reliable and resident through crises.

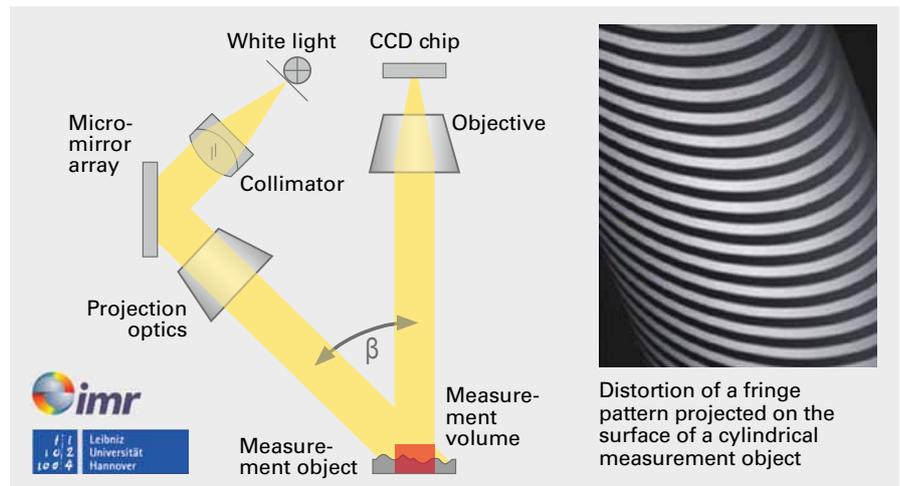
Best regards,

Volker Pape  
Executive Board  
Viscom AG

Dr. Martin Heuser  
Executive Board  
Viscom AG

Process optimization by solder paste inspection

3-D SPI: More than just defect detection



Principal structure of fringe projection

During the solder paste inspection, electronic assemblies which do not meet the specified criteria are already sorted out after paste printing. On the one hand, this avoids unnecessary costs due to placement of components, especially when faulty assemblies in production are no longer repaired after soldering, but scrapped.

On the other hand, with its evaluation of the 3-D measurement data of all pads on the assembly, SPI also offers the possibility for process control through feedback of results to the paste printer, for example in the case of print offset.

Especially in the sector of high quality products in the electronics industry, for these reasons 3-D SPI has increasingly asserted itself so that the question of how to optimally exploit these systems gains pertinence. It has often been seen that SPI serves exclusively to point out clear mis-

takes in the paste print, where the volume deviates from the reference value by more than 50 %.

continued on pg 2 ▶

Contents:

	1-3 <b>Technical Article</b>	- 3-D SPI: More than just defect detection
	4 <b>Software/Products</b>	- vVision: Successful in practical test at Osram - X7056: In-line inspection
	5 <b>Products</b>	- Viscom's demanded 3-D solder paste inspection
	6 <b>Company</b>	- Young colleagues – Viscom educates
	7 <b>Events</b>	- Research laboratory promotes natural sciences - Upcoming shows

◀ continued from pg 1

Over and above these possibilities, new approaches are presented by linking the SPI results with those of the AOI. Once again it is the software that allows the degree of utilization for SPI to be significantly increased.

Because many of the SPI systems available on the market function on the principle of fringe projection, this technology deserves another presentation here.

A light source and corresponding optics are used to project a fringe pattern at a certain angle on the printed circuit board and so onto the pad with printed solder paste. This solder deposit distorts the fringe pattern to a certain extent, thereby permitting conclusions about the height. The actual unknown dimension here is the phase shift by which a pixel or a grayscale value is altered, from which the precise height of the paste deposit can be recalculated.

This yields a 3-D height profile of the entire printed circuit board which when combined with the pad CAD data for the electronic assembly – usually Gerber data – allow the paste volume, average height, form and displacement of the paste deposit to be calculated and classified for each pad. Additional defect criteria include paste smearing and formation of paste bridges from one pad to another.

Just as for other types of inspection systems, the primary criteria for assessing performance capacity of SPI systems are inspection depth and throughput. The inspection depth of an SPI as essentially a measurement system depends greatly on its absolute and repetitive accuracies.

Absolute accuracy describes the maximum deviation between mea-

surement and reference value, while repetitive accuracy indicates the limits within which a measured value may range over a number of repetitions, e.g. 50.

Another important performance criterion for SPI system is throughput, stated in  $\text{cm}^2/\text{s}$ . This depends strongly on lateral resolution because with the same number of pixels in the camera, the image field is smaller at better (higher) resolutions. Depending on resolution, surface rates of  $30 \text{ cm}^2/\text{s}$  to  $100 \text{ cm}^2/\text{s}$  can be attained. Generally this is adequate to meet the pace of modern paste printers.

### Evaluation of SPI data

As explained in the introduction, the primary task of SPI is to detect pads with an evident deviation from the reference value in order to prevent subsequent solder defects. The question at this point is, what constitutes an „evident“ deviation.

Without further ado, the performance capacity of SPI systems described above permits inspection for volume or average height with defect thresholds of e.g.  $\pm 20\%$ . Initially the expectation is that modern systems ought to maintain these thresholds during paste print; this is especially beneficial for the resulting solder quality as well.

However, in practice it has been determined that these thresholds do not permit sufficient output simply because too many printed circuit boards are stopped after inspection. This is not because the SPI has made incorrect measurements but because in reality, the paste print regularly exceeds these stated defect thresholds.

Thus, after various iterations, the operator generally applies defect thresholds of  $\pm 50\%$ . On the one

hand, this is compatible with practice because experience indicates that even significant over- or underprinting yields solder joints of sufficient quality to pass the typical optical, electrical and functional tests. Yet experience also indicates that even before the defect threshold is reached, the risk of subsequent solder defects such as solder beads and tombstones is clearly increased. These types of defects also represent an indicator for sub-par paste print.

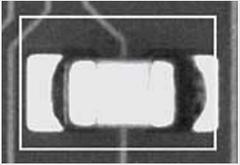
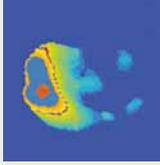
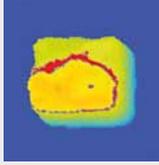
On the other hand, operating a system that is capable of measuring solder paste with a high degree of (repetitive) accuracy but which then only detects very rough printing errors because of widely expanded defect thresholds is rather unsatisfactory.

### Uplink integration of SPI and AOI

Further concepts for applying the SPI results go beyond straight evaluation to detecting defects in paste print. Such approaches include the evaluation of process errors, referring to pads which are not evident defects as the 50 % threshold would indicate but almost reach it, for example lying within a 40 - 50 % deviation from the reference value. In addition, the SPI results must be integrated with the AOI results because of the synergies arising from this combined evaluation.

Therefore, when solder quality is considered, it makes sense to also display the image and result values of the SPI during classification of the AOI inspection results even if the 50 % defect threshold has not been exceeded. For example, if insufficient solder was indicated as a defect by the AOI and the paste print has already been indicated as a process defect at the same operating station,



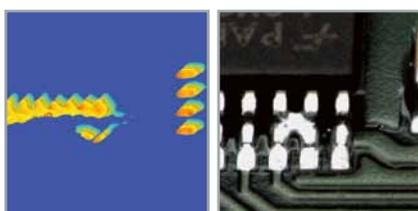
Solder defects	Pad left	Pad right
		
<b>Solder value:</b> 120 <b>Threshold value:</b> 160 <b>Acceptance:</b> 75 %	<b>Absolute height:</b> 80 µm <b>Percentage height:</b> 66 % <b>Absolute volume:</b> 40 nl <b>Transfer efficiency:</b> 70 % <b>X-displacement:</b> NN <b>Y-displacement:</b> NN	<b>Absolute height:</b> 120 µm <b>Percentage height:</b> 100 % <b>Absolute volume:</b> 60 nl <b>Transfer efficiency:</b> 100 % <b>X-displacement:</b> 50 µm <b>Y-displacement:</b> 10 µm

Example of an AOI-SPI report

the operator has a much easier job of making a correct classification. This way, the recurrent effect of classifying real defects as false alarms due to human error can be reduced.

Paste print also frequently produces paste bridges which, however, to a certain extent disappear on their own during soldering. The picture shows: in the 3-D picture there are paste bridges between all pins, whereas after soldering only one bridge is remaining.

Until now, electronic assemblies with the solder bridges detected by SPI were correctly sorted out. However, if one is aware that the greater portion of the bridges are no longer present after soldering, the Viscom Uplink offers another approach. The paste bridges are transferred to the AOI classification station, where the operator makes a single check to see if the former paste bridge is still present



Paste bridge after printing and after soldering

ent as a solder bridge. This prevents printed circuit boards from being unnecessarily sorted out after paste printing, saving time and money.

Previous long term investigations have not succeeded because there was no automatic link between SPI and AOI. Not only does the Viscom Process Uplink now make it possible to display the paste image and result values (volume) at the AOI classification station for each solder defect, but these can also be saved in a structured way. This provides a report for each electronic assembly juxtaposing solder defects with the corresponding results from the SPI.

Because the numerical feature values of both AOI and SPI are saved in such a way that they can be retroactively read in by typical evaluation software, nearly any sort of evaluation is possible. For example, SPI provides the volume as absolute value and as transfer efficiency, the average height, the print offset and a form feature for each pad.

The stated possibilities for extended use of the SPI results take on enhanced significance when applied to AXI. Because the hidden defects evade visual inspection during de-

fect classification after post-reflow soldering, the operator must rely solely on the X-ray image and so receives especially helpful information through the display of 3-D paste image and 3-D measurement values.

The primary requirement for the specified functionalities is the combined software platform of Viscom SPI and Viscom AOI.

### Conclusion

3-D solder joint inspection is the new standard in SMT production of high quality electronic products. The capacities of this system go beyond pure defect detection on solder paste print. Effective process control is only attained by a systematic juxtaposition of solder defects caught by AOI with images and features from the SPI.

The display of 3-D paste images for classification and possible repair of solder defects also heightens effectiveness and prevents defect escape caused by human error. All the functions and combinations mentioned here are also directly transferable to X-ray inspection (AXI) of post-reflow electronic assemblies.

Experience the practical application of the S3088 SPI during our live presentation at Productronica, Stand A2.177, or in-line at the ASM In-House Show. ■

Viscom  
download



This article has been abridged. The complete technical article is available under:  
[www.technical-articles.viscom.com](http://www.technical-articles.viscom.com)



Viscom's new vVision operating software

# Successful in practical test at Osram

The new operating software for all Viscom AOI, AXI and SPI inspection systems has passed practical testing. Thorough examination and optimization during numerous trial runs in production have determined that this software is the anticipated great step forward in the operation of inspection systems. Thanks to simple navigation on the touchscreen and consideration put into the essential setting options, system operators arrive at a high performance inspection program very quickly. With the vVision Operating Software, AOI operation is simple and convenient.

After receiving an extremely favorable response from customers at its first presentation, vVision is now running after a lot of practical testing. The new operating software has been installed on the S3088 flex AOI system and is inspecting PCBs in series production at a major European Viscom customer's plant.

Especially exciting, is the new optimizing function with 100 percent class separation. With this display,

the specific areas of the solder joints and components that are inspected as good or bad (defect images) are displayed. Now, a representative depiction based on clearly legible diagrams is even more easily to realize with vVision.

The slider for threshold value shift now provides a very simple, intuitively operated tool for program optimization and reduction of false alarms. Now, even a new AOI system can be immediately deployed for quality assurance without comprehensive training or expert knowledge on the part of the operating personnel.

This also has been noted by E. Sestan, responsible for Vision Systems for Manufacturing at OSRAM AG. He has tested the software on various production lines and concludes, „vVision does not require image analysis experts for program optimization. The new platform is structured to allow management of the AOI in a more intuitive way. With a modern graphical interface using touch screen similar



E. Sestan, Automated Vision Systems for Manufacturing, OSRAM AG with S3088 flex equipped with vVision software

to current models of phones, it is very enjoyable, fun to use and efficient. The programming environment is component oriented. Former inspection results are taken into consideration. This approach allows a drastic reduction of false calls and helps to avoid real errors," adds Sestan.

Peter Kruppner, Vice President of Viscom Serial Systems, affirms, „The reactions at OSRAM show us that we are on the right path. With vVision, system operators are able to realize program generation and optimization with little to no training. This customer feedback reflects the overall picture – vVision fulfils the customers' needs. Visually and from its capabilities, the software is a direct hit." ■

Flexible AOI/AXI

## In-line inspection system X7056

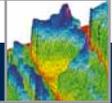
Components such as BGA, QFN and QFPs are gaining ground. Their advantages concerning electronic devices in the areas of weight, space requirements and performance are beyond dispute. Being that their connectors are mostly hidden, many solder joints can be reliably checked with an X-ray inspection. To be able to carry out this inspection, not only precisely, but also with a high throughput, Viscom has developed the X7056 inspection system.

The X-ray unit of the system is equipped with a special microfocus X-ray tube. The 5 µm resolution of the X-ray image chain ensures viewing with the highest possible detail even with automatic operation. However, for in-line operation, both image quality and speed are crucial. That is precisely the strength of the Viscom X-ray technology.

This is achieved with a so-called flash mode, which operates with an increased tube performance and re-

duced exposure time. The special control of the tube technology makes it possible to move the electronic assembly to the next inspection position immediately after the exposure while still transmitting the image. Thus, the speed that is so important for in-line operation is realized while maintaining a constant image quality – with a time savings of 20 - 25 percent.

Because it is not always necessary to X-ray the complete electronic as-



sembly, the inspection system can be used both as a pure in-line X-ray inspection setup and a combined system with a full AOI. The pronounced inspection depth of the tried and tested Viscom AOI systems is achieved via the integration of the optical 8M

sensor technology, orthogonal or angled. With the OnDemandHR function, the AOI resolution can be flexibly switched over from 23.4 to 11.7  $\mu\text{m}/\text{pixel}$  with the full image field size. In the angled view, a range of 16.1  $\mu\text{m}/\text{pixel}$  to 8.05  $\mu\text{m}/\text{pixel}$  is possible.

For electronics manufacturing, this means the highest possible flexibility. The inspection can be used in a staggered manner in order to decide, depending on the electronic assembly, what is to be inspected optically or where X-ray technology is to be used.

Batches 2011 were already fully booked in July

## Viscom's demanded 3-D solder paste inspection

In March of this year, Viscom introduced its 3-D SPI solution that integrates the tried and tested sensor technology from CyberOptics. The new 3-D SPI system checks paste printing with the highest possible speed and precision and enjoys high demand. The batches planned for this year were already fully booked in July.

This new addition to the Viscom product line combines the advantages of its market-leading AOI system with powerful 3-D SPI sensor technology and inspects solder paste printing with the highest possible speed and precision. Even the most demanding electronic assemblies with CSPs or micro BGAs and pad sizes of 01005 are reliably inspected. In addition to the customary 2-D inspection for misalignment, completeness and smearing, soldering paste height, surface area and volume also are reliably recorded and inspected.

The S3088 SPI 3-D technology does not require calibration. With the fringe projection method, the robust sensor head does not use movable parts. Depending on demand and the electronic assembly, two different test modes are available: the high resolution (HR) mode with an inspection speed of up to 50  $\text{cm}^2/\text{s}$  and the high-speed mode with an inspection speed of up to 80  $\text{cm}^2/\text{s}$ . As a result, inspection can be optimally adjusted to the electronic assembly and the respective requirement.



F. l. t. r.: André Dahlhoff, Deltec CEO, and Thomas Fischer, Project Manager at Deltec, with the new Viscom S3088 SPI system

This concept also convinced André Dahlhoff, CEO of Deltec Automotive GmbH & Co. KG in Furth im Wald, Germany. As supplier to the automotive industry, Deltec must meet high standards. The reliability of the manufactured electronic assemblies as well as the highest product quality and productivity must be guaranteed. „We are happy to now be able to work with the customary high Viscom standard for solder paste inspection. The performance of the S3088 SPI system convinced us during the evaluation. We appreciate the high quality of Viscom products. It was not only the inspection performance, but also the entire mechanics and workmanship that convinced us.“ He added, „With Viscom, we have a development partner that responds to the require-

ments and wishes of its customers, in addition to reliably supporting us with its service and support.“

In addition to its reliable paste print inspection, the S3088 SPI system offers a unique Process Uplink. Where other inspection systems only distinguish between good and bad, this software add-on also enables the use of process indicators. Additionally, with the valuable image database with SPI and AOI error image pairs, electronics manufacturing companies now have a simple way to improve their processes.

The S3088 SPI is fully compatible with all Viscom inspection systems. Of course, the Viscom post-classification and the SPC statistics also are available.



Viscom greets the new 2011 apprentices

## Young colleagues – Viscom educates



F. l. t. r.: Industrial business administrators: Stephan Dreger, Vanessa Gieseler, Sandra Strube and Ann-Kristin Gerholz with their coordinator Birgit Riebesehl, electronics technician for systems and equipment: Patrick Schwärzel with his coordinator Jens Haupt

As in every year, in August 2011 a new phase in the lives of several young people began at Viscom: they started their training at Viscom as industrial business administrators and as electronics technician for systems and equipment. These new apprentices – this year there are five – can expect many new experiences and insights into very different departments and work processes. The ap-

prentices in business administration, for example, will go through the areas Sales, Accounting, Controlling and Marketing. Apprentices in technical areas will find experience in specialist departments including component manufacture, series production and special production as new challenges.

„The best thing about it is, this way they become acquainted with widely varying jobs in a practical context. This is often the only way they can decide which area suits them and they can enjoy. It has also already occurred, that someone finds their heart lies in controlling even though initially, he thought this was not for him,“ says Birgit Riebesehl, coordinator of apprenticeships in industrial business administration. Jens Haupt, responsible for the apprenticeships in technical areas, adds: „It is also the case at Viscom, that our apprentices learn by doing. After a thorough introduction during an initial phase, they soon come to work on real projects under supervision. They learn the relevant contents in actual practice and work in teams with colleagues. This way, occupation with small, everyday sub-projects quickly conveys what it means to take responsibility in working life.“ We wish all the new apprentices a successful entry into their career lives. ■





Viscom supports the Gebrüder-Körting School

## Research laboratory promotes natural sciences

The Gebrüder-Körting School in Badenstedt, Germany, is different. These are not only the words of the school principal Michael Leonhard, but can also be heard when speaking to the parents. "Different" means: cooperative learning, including all children and teaching and promotion of independent activity. In concrete terms this means that all children learn together; students from very different family homes, with or without migration backgrounds, the physically disabled and those with learning problems just the same as advanced learners. Class levels are also mixed. In this way, for example the first and second classes and the third and fourth learn together. This encourages mutual help and support.



As a result, this school has become a showcase. In order to further this practice-oriented, independent learning model and in particular to awake interest in the natural sciences, a re-

search laboratory is in the planning stages. The laboratory is being constructed and equipped with the help of private sponsors, among them

Viscom. In the future, it will even be made available to other institutions as well. ■

## Viscom upcoming shows – We cordially invite you



**Productronica 2011**  
15.-18.11.2011  
Munich, Germany  
Hall A2, Stand No. 177



**IPC Conference 2012**  
20.-22.03.2012  
Budapest, Hungary



**Nepcon Shanghai 2012**  
25.-27.04.2012  
Shanghai, China



## Imprint:

Publisher:  
Viscom AG  
Carl-Buderus-Str. 9 - 15  
30455 Hannover  
Tel.: +49 511 94996-0  
Fax: +49 511 94996-900  
info@viscom.com  
www.viscom.com

Editor:  
Martina Engelhardt  
Tel.: +49 511 94996-531

Graphics and Layout:  
Gaby Reglitz

[www.viscom.com](http://www.viscom.com)