

## Case Study



3D AOI

3D AXI

3D SPI

3D MXI

**DELTEC**  
Intelligently networked  
3D inspection



Harry Kuckelkorn, general manager at DELTEC, and account manager Walter Schneider from Viscom in front of the S3088 SPI

## Strong partners on the entire line

*DELTEC Automotive GmbH & Co. KG, located in Furth im Wald in Bavaria, Germany, is an electronics manufacturing services (EMS) provider known throughout Europe. With approximately 250 employees, the company can realize even the most complex orders with the highest quality. This requires end-to-end stability in the series process. For their SPI, AOI and AXI/MXI inspection technologies, DELTEC relies on 3D systems from Viscom AG.*

The products manufactured at DELTEC range from safety and medical technology through office and data communication. The company's largest customer group, however, is the automotive sector. Components from DELTEC are found in vehicles from the

portion of their products. This is why DELTEC experiences the ongoing changes in the lighting technology field every day.

### Decisive high quality

Until very recently, the LEDs installed in vehicles typically had a classical component body with leads on the sides. New types of LED components, for example, the chip-scale packages (CSP), no longer have sheathing that extends past the light source. The illuminant surface dictates the size of the component. In SMD production (surface-mounted device), this change resulted in new challenges to be professionally mastered. Markus Seidl, head of quality management at DELTEC, sums up these requirements:

**“This concentration on quality is also reflected in our technologies. We work closely with suppliers that place an equally strong emphasis on technological value.”**

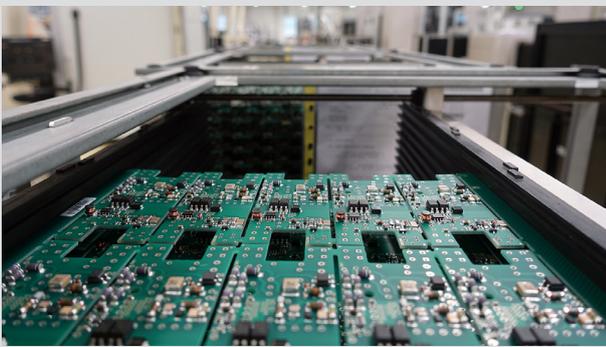
most popular European automotive manufacturers. These components range from sensor, ignition and control technology to charging adapters and window closing systems. Headlights and taillights make up a significant

“It all comes down to the paste volume on the printed circuit board, how it flows, how it appears in the X-ray image and how high the percentage of voids is; position accuracy is also crucial.” Quality and zero defect escape

are basic prerequisites in the automotive industry. “This concentration on quality is also reflected in our technologies. We work closely with suppliers that place an equally strong emphasis on technological value,” adds Thomas Fischer, production and process technology manager at DELTEC. For these reasons, one of the company's reflow ovens is equipped with a vacuum chamber. “Naturally, the results under vacuum are excellent. We can achieve less than two percent air inclusion with this technology,” declares Fischer. But the disadvantage of this option is increased cycle time.

### Ultra-modern inspection technologies

About 25 percent of the production surface at DELTEC is devoted to inspection technologies. Machines and software from the automatic optical inspection (AOI), solder paste inspection (SPI) as well as automatic and manual X-ray inspection (AXI/MXI) areas are central elements in quality management. DELTEC applies them to the corresponding paste and solder joint inspections, random testing of complex automatic processes and to making high-performance, high-quality large series production a reality.



From accepting all the smallest parts to delivery of the complete electronic assemblies, each logistical step at DELTEC is transparent



Classifying inspection results is comfortable and easy on the clearly laid out, ergonomic HARAN verification station from Viscom

These 3D inspection systems all come from Viscom in Hanover, Germany. Among them are several S3088 SPI and S3088 *ultra* systems. This has a decisive advantage: Using the combined results for process analysis and qualification is relatively simple. The data this requires are generated and evaluated on a software platform spanning all the systems. One exceptionally useful option in this context is Viscom training for the DELTEC employees occupied with process support and inspection program generation.

Increasing piece counts at DELTEC are just one of many reasons intelligent, automated inspection is more and more indispensable. "We passed the ten-million-piece mark for the first time in 2015. This included extremely complex electronic assemblies, as well as the simplest. But this is also an important topic for Viscom, because every single piece passes through the SPI and AOI systems," explains Rainer Müller, manager of marketing and sales at DELTEC.

### 3D SPI for more information

From DELTEC's perspective, paste print represents the most important causal variable in the SMD process. A 3D paste inspection provides the employees comprehensive process-

relevant data essential for qualifying and stabilizing a series process. As well, more and more of DELTEC's automotive customers insist on a 3D paste inspection for hidden solder joints. Here, the images and measurement values generated by the inspection are a great help in

classifying defects. Fischer states, "With this inspection technology, we are handed information about volume, paste height and other aspects and suddenly see, there are actually differences between one and another of the components which could not be determined in any other way."

As one example, the paste print for 0201 components can no longer be inspected manually. Automatic inspection is the only option and a paste offset of 200 or 300  $\mu\text{m}$  is already not acceptable. In their lines, DELTEC employs automatic data exchange (Closed Loop) between the Panasonic SP18 stencil printers and Viscom S3088 SPI solder paste inspection

systems. In practice, this yields concrete advantages: Depending on the solder paste offset values determined by the 3D SPI system, the print offset is automatically corrected over several printed circuit boards. The number of steps this correction is carried out in can be defined. For example, an offset

is not corrected in one single step, but over several intermediate steps. This then reaches the optimum result. Fluctuations between printed circuit board materials can also be easily compensated with the Closed Loop from Viscom.

In the past, the print offset had to be manually adjusted over and over. "Then it was a matter of extreme swings in one direction or the other. This cost time and never resulted in the quality I would get with simply automating the adjustment," recalls Fischer. With the Viscom paste inspection systems, customers can also optimize their stencil-cleaning cycles based on the SPI results. Yet another

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At DELTEC, the newest high-value equipment from leading manufacturers guarantees the highest quality

plus from Closed Loop: The S3088 SPI communicates not only with the paste printer, but with the placement machine as well. Thus, placement offset can also be corrected.

### Presence inspection with 3D AOI

In the AOI area, DELTEC uses 3D inspection especially for SOT (small-outline transistor) component body detection. In this case, the advantage of 3D inspection is greater stability, which is seen in lower false alarm rates. Thomas Fischer: "Of course there will always be important optical factors, such as the great number of different body designs with barely enough contrast to distinguish them from the printed circuit board background. The 3D AOI is simply better at this."

This inspection technology will be a mainstay at DELTEC in the coming years. "In the future, we will also record menisci with 3D AOI; this is a recurring topic for our customers," states Fischer. This involves ensuring the inspected meniscus actually is IPC-compliant and definitively extends up to a prescribed component height. In addition to the 3D inspection, DELTEC also employs 2D and 2.5D methods in the AOI area to inspect its assemblies (orthogonal and angled). Inspection libraries, com-

plied and optimized by the company over 15 years, are the solid basis for these inspections.

### Intelligent data combination

At DELTEC, highly precise assembly with LEDs is a core process. With modern LED types, the solder joint quality can often only be verified with X-ray. If defects such as air inclusions or solder beads are then determined, the result of the paste inspection system is extremely important for optimizing the process. By linking the results, DELTEC can react quickly to such defects. This is enabled by the data combination

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possibilities offered by the Viscom Quality Uplink. "When the AOI system indicates that I have, for example, a bad solder joint, I need to know what it was caused by. Then I receive the linked paste information and see, OK, I have stayed within my limits, but still I must take action. For example, maybe the specified paste volume I am working with is too low. Something like this is very important, especially during

the sample phase," emphasizes Fischer. The relevant image information can be evaluated with the Viscom Uplink Process Analyzer (VUPA). The Closed Loop connections are also a software element of the Viscom Quality Uplink.

### High-value X-ray systems

DELTEC consciously purchased the Viscom X7056RS with its AOI and AXI functions so they would be able to run a combined inspection in cases where the automatic optical inspection comes up against its limits, due to shadowing or other characteristics. The system is increasingly used for process

qualification. "Recently, we tried out and evaluated several different stencil designs for a specific product: a little more paste, a little less paste, a slightly modified paste volume. We verified the results with the AOI and evaluated the statistics files," explains Fischer.

Alongside of this, DELTEC uses the Viscom X8011 PCB *plus* for manual X-ray inspection. One of the advantag-



Two DELTEC colleagues with a number of mutual interfaces: Thomas Fischer, manager of production and technology, and Markus Seidl, head of quality management

es: "It is possible to take a printed circuit board to the machine and quickly see what is happening with a critical solder joint, without having to set up an elaborate program," says Fischer. The system lends itself to highly versatile application and enables immediate manual inspection if anomalies crop up in production or for handling complaints. The application fields are similar to those for the X7056RS, especially for checking solder filling in the THT (through-hole technology) area or inspecting SMD voids.

### Statistics and traceability

For real-time evaluation, DELTEC leverages the possibilities offered by Viscom statistical process control (SPC). Each production line is equipped with an SPC monitor. An update arrives every two or three minutes. This means that when, for example, a real defect is classified on the AOI station, the corresponding display promptly appears on the line and the operator receives just-in-time information indicating whether the specified limits are maintained or intervention is called for.

At DELTEC, any electronic assemblies found to be defective are locked against further processing steps. This was made possible by a Notes databank solution based on barcode

control, which the company developed in concert with an external programming team. "Result files are stored within several different inspection steps. Our DELTEC locking system, or DLS, collects these files and if a circuit board receives a negative status, it is correspondingly locked during the downstream processes," explains Fischer, and continues: "We have 100 percent traceability. A barcode scanner is positioned before each machine. Affixing labels is also a very important step and is the first link in the complete traceability chain."

### ISO/TS 16949 and other certifications

DELTEC's orientation stands on a long history. In 1996, the company was certified in accord with ISO 9001, an essential requirement level for quality management. DELTEC began setting its course for the automotive sector in 2003, as it opened its new Engineering Center. "At this point it was clear that we needed to work on our structures again to meet the requirements of ISO/TS 16949," states Harry Kuckelkorn, general manager at DELTEC. This is a set of technical specifications based on ISO 9001, specifically arranged for the automotive industry and one of the important foundations for the DELTEC processes and systems. "This

is 28 sections and over 100 orientation points for controlling complex processes within the company and to ensure the reaction capabilities needed to enact preventive safeguards," explains Kuckelkorn.

Certification under environmental management standard ISO 14001 followed in 2006; in the near future, the company expects to complete the ISO 13485 certification process for medical products. Preparations for this step are in full swing.

Harry Kuckelkorn knows what he is talking about. He is a council member and delegate at the German Institute for Quality (DGQ) and currently has a teaching assignment with the Institute for Police and Safety Research at the School of Public Management in Bremen, Germany, where he holds lectures on quality management and conducts the examinations in this subject. "I do this mainly to give back something of what I was given when I was a student," says Kuckelkorn about his teaching activity.

### Long-term advance planning

The DELTEC general manager underscores the major role played by the long-term character of the automotive sector: "Processing a request can take

up to several months. This means it can continue through five to eight negotiation rounds until everything has finally been settled; then the customer makes the decision of whether we receive the acceptance," as Kuckelkorn knows from experience. From that point, over a year can pass

The business relationship between Viscom and DELTEC has also been established for the long term. "Everything we do turns out well; we have been working together since 2001. From our view, the cooperation is very good, including the contact partners in Hanover. And, Viscom is always at

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before production actually starts. But this long runup with planning, prototyping and pre-series does pay off. The completely workable order can be planned to run from four to eight years. Harry Kuckelkorn adds: "As soon as we receive an inquiry, it is assigned to a project manager." The project manager then works together with the customer until the end of the product cycle.

the forefront of technological development," states Thomas Fischer. This means future challenges are better mastered.