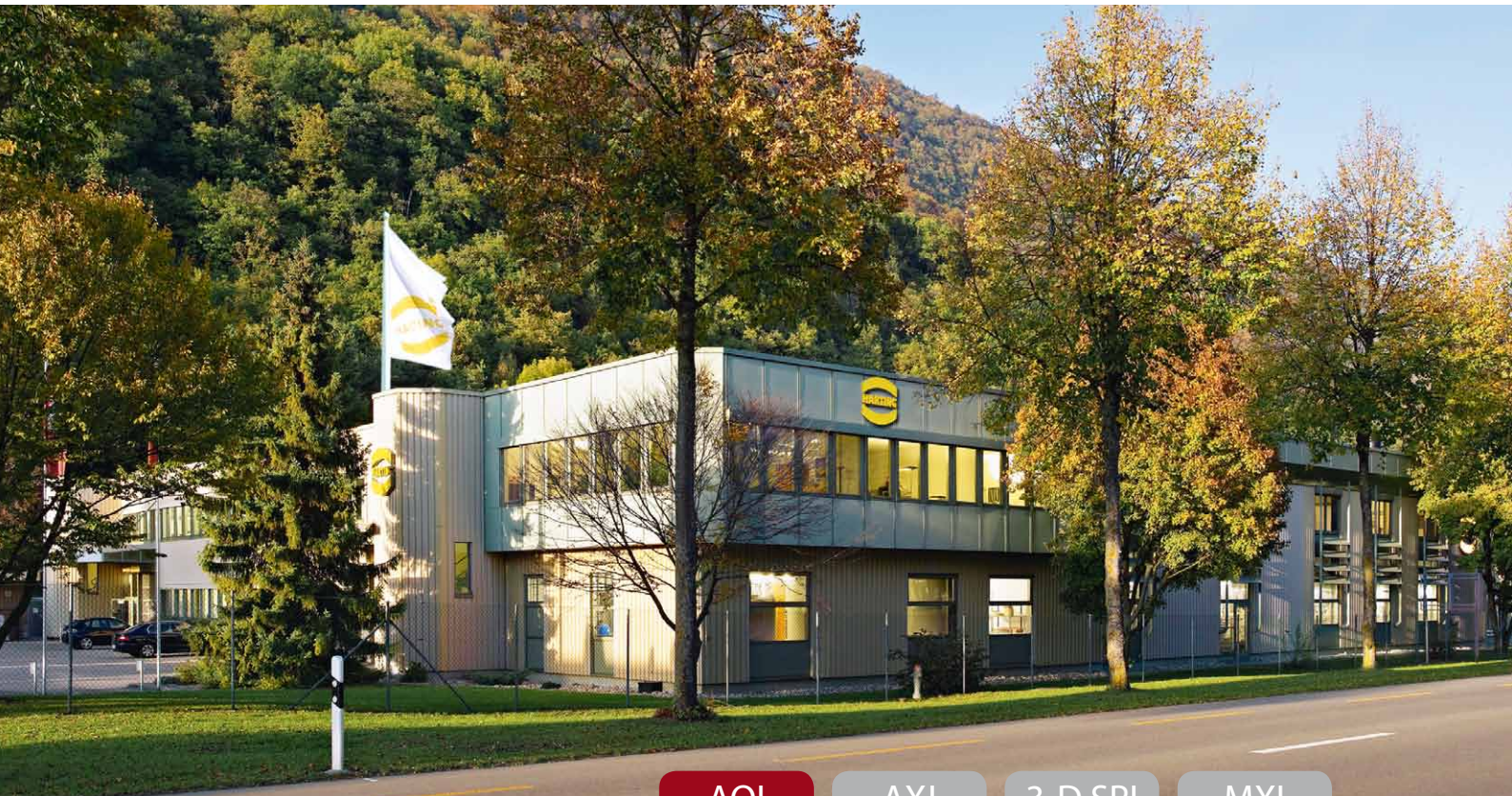


Case Study S6056 MID



AOI

AXI

3-D SPI

MXI



Pushing Performance

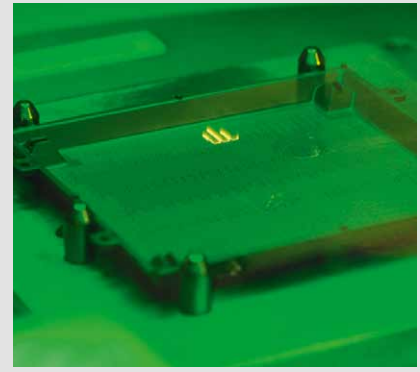
HARTING AG
3-D MID Component Inspection
with Viscom S6056 MID



Albert Birkicht and Guido Schatz, HARTING AG and Torsten Wichmann, Viscom AG



LDS method: Injection molding



Laser activation

Inspecting in three dimensions

The HARTING AG is increasingly using 3-D MID technology (Molded Interconnect Device) for its customers from the automotive and medical technology sectors who demand very high quality. Three-dimensional MID components made from plastic contain metalized conducting paths. The electronic components can be assembled directly on the plastic components. Thus, the 3-D MID enables particularly compact and geometrically adapted electronic components, which can also be used for products that are extremely small and specially shaped. Quality control is very challenging during the 3-D MID production because of the three-dimensional structure. Up to now HARTING has paid particular attention to elaborate visual inspections. In the meantime, the Viscom S6056 MID inspection system is used, which enables automatic inspections at maximum quality.

From connection technology and network components through to 3-D MID production

HARTING develops, manufactures and sells electrical and electronic connectors, connection technology, network components as well as cable harnesses. Products from HARTING are

used, for example, in industrial communication and in grids for supplying energy. The customers are mostly companies from mechanical engineering and plant construction, automation technology, energy production and distribution as well as electronics and telecommunications.

The head office of HARTING is Espelkamp near Minden. In the fiscal year 2011/12, the group with about 3,500 employees generated a turnover of 479 million Euros. In the meantime, HARTING has eleven production plants in Germany, Switzerland, Great Britain, Rumania, the USA and China as well as over 40 subsidiaries and agencies in 37 countries. More than 400 engineers and scientists work in research and development. The company established in 1945 is one hundred percent family owned.

At the location of Biel in Switzerland, HARTING develops and manufactures customer-specific 3-D MID solutions. The S6056 MID is also deployed here for inspecting an assembly for distance control systems in vehicles. The assembly controls the radar antennas used for the distance measurement. Conducting paths and SMD components are on the three-dimensional surface of the assembly.

The conducting paths are created in the LDS method (Laser Direct Structuring). During this process, a laser works out the conducting paths from the LDS-capable plastic by activating metal particles within the material. HARTING solders the SMD components with a vapor phase.

The search for a reliable, cost-effective 3-D MID inspection

“Certain faults, such as tombstone effects when soldering, can be never avoided entirely even in the best and most stable production process”, explains Albert Birkicht, the Managing Director at the HARTING AG in Biel. “A small percentage of faults always occurs. The inspection must detect these faults reliably, especially in the case of customers from automotive and medical technology. Quality requirements are particularly high in these sectors.”

HARTING has relied on elaborate manual inspections during the 3-D MID production until now, in which a certain amount of slippage could never be totally eliminated.

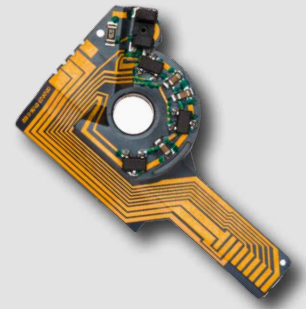
In addition, it has been noticed at HARTING that the manual inspection can distort statistical evaluations. “If the inspector detects a really conspicu-



Plating



Electronic assembly



3-D MID product: Distance sensor

Case Study S6056 MID

ous fault on an assembly, this can lead to additional faults no longer being recorded at all. In particular because the assembly is already discharged after the first fault", explains Birkicht. "Then only this particular assembly with the conspicuous fault is recorded in the fault statistics and we lack important indications for optimizing the process."

"Support, flexibility and technology are real strengths of Viscom."

For this reason, at HARTING they have been searching for an automatic inspection solution that provides maximum quality and is more cost-efficient. Here, it quickly became apparent that this not only concerned a typical inspection of a printed circuit board. The challenges involved in a 3-D MID AOI, particularly with regard to sensors and printed circuit board handling, are very high. 3-D MID products differ far more significantly from each other than electronic flat components. Therefore, there is no standard testing process for the inspection. The introduction of a 3-D testing system requires flexible support by the manufacturer and an efficient basic system

that can be adapted to the inspection task concerned.

"Support, flexibility and technology are real strengths of Viscom", says Birkicht. "Viscom has supported us intensively during the customization of the system – right through to the development work. In addition, Viscom is involved in the 3-D MID e.V. Thus,

it quickly became clear to us that the company regards 3-D MID as a strategic issue and will be in a position to meet our requirements."

The series system S6056 which is fully developed and flexibly adaptable to the requirements forms the technical basis for the 3-D AOI. The inspection system provides a z-axis, a high inspection depth and speed as well as verification and traceability solutions. The visual inspection of a three-dimensional circuit carrier is influenced primarily by the complex shape and contour of the product. Therefore, the inspection system must be able to inspect at various levels. Furthermore, very different manufacturing process-

es are used during the 3D MID production, for example, assembling with the aid of soldering paste, conductive adhesive or bonding. In addition to this, the conducting paths are often not uniform but can look completely different owing to the manufacturing process. The inspection requirements and diverse fault characteristics must be defined precisely in a fault catalog with exact threshold values. Depending on the type of faults expected and the necessary throughput, it must be possible to specifically adapt the resolution, inspection speed, lighting, color settings and camera angle.

S6056 MID: 3-D AOI inspection in two stages

The 3-D inspection at HARTING takes place in two stages: "In the first stage, we mount 20 unassembled 3-D MID components onto a workpiece carrier", explains Guido Schatz, AOI operator in the company. "After that, the assemblies run through the Viscom system as panels. This first inspects the metallization of the lasered and galvanized copper, nickel or gold conducting paths and the terminal pad." Typical faults include foreign metallization, incomplete, detached, short-circuited or torn conducting paths as



3-D MID product: Microphone carrier for hearing aid

well as geometric defects of the product or detectable faults to color variations on the two-component injection molding. In the case of 20 assemblies, the first inspection stage lasts approx. 200 seconds. HARTING then assembles and solders them by means of a vapor phase.

In the second stage, the S6056 MID system inspects the assembled boards: "The system determines within 60 seconds whether the right components are present, positioned and poled correctly on all assemblies of the panel", adds Schatz. "Additionally, it detects inadequate solder joints, tombstone effects, short circuits and faults on the solder resist." The solder joints are difficult to inspect owing to the geometry of the component. The same applies to the solder resist, which is dispensed in very small points.

The heart of the S6056 MID system is a powerful AOI sensor moveable along three axes (x, y, z) based on the Viscom 8M camera module with four orthogonal (top view) and eight angled cameras in a housing. The sensor module has an adjustable resolution. For orthogonal inspection it is 23.5 μm or 11.75 μm and for angled inspection 16.1 μm or 8.05 μm . This makes it pos-

sible to safely inspect components up to type 01005 (0.2 by 0.4 millimeters). In order to work out different inspection characteristics and achieve optimum contrast, various type of lighting are integrated.

Outlook

"We are very impressed by the results of the Viscom 3-D inspection system", says Birkicht. "The quality of the inspections and evaluations is high and the throughput has increased considerably at the same time. The automatic inspection is unerring: No fault is lost, processes can be readjusted unerringly and thus the quality of the entire production process ultimately increases."

HARTING currently uses the 3-D system for the inspection of the assembly for the distance control system that is manufactured in large numbers. "We will gradually inspect other 3-D MID products also with the Viscom system, especially the high-volume products that have particularly high quality requirements", Birkicht explains. "The capacity is expected to quickly reach its limits, which is why we are already thinking about a second S6056 MID system."