



View everything with VERSAEYE

Exterior view of Flex in Zalaegerszeg in Hungary.

# Global Player Flex has successfully worked with Erska GmbH for 38 years

Flex is one of the world's leading product design and manufacturing companies. For 38 years, the global player has relied on the support of system supplier Erska to expand its production. Recently, a complete VERSAFLOW 3/45 selective line with au-

tomatic lifting and lowering station as well as automatic optical inspection unit (AOI) made its way to Zalaegerszeg in Hungary. Known to many as a popular holiday region not far from Lake Balaton, it is also a real stronghold of electronics production.

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Commissioning and cleaning of the VERSAEYE AOI.

Constantly increasing demands on machine availability and in particular the quality assurance of the finished soldered products, as they have long been known in reflow soldering, are also increasingly being used in the selective area. When it comes to maximum flexibility – combined with high machine availability, fast cycle times and a minimum error rate – VERSAFLOW is a must. But how can it be documented that the properties mentioned are actually constantly available? In order to be able to offer a reliable solution here as well, Ersa has the AOI (automatic optical inspection) under the name VERSAEYE in its product portfolio, which is now also being used at Flex in Hungary. At first glance, it is striking that the AOI is integrated directly into the machine housing. This simplifies the process interlocking considerably, because with a continuous machine housing between soldering and inspection, a PCB cannot be exchanged at any time.

#### GOOD SOLDER JOINTS, BAD SOLDER JOINTS

Basically, the AOI is a camera system, which should reliably distinguish good from bad solder joints on the basis of predefined test samples. It is important to protect the system as best as possible from external influences. Ideally, no light enters the camera system from the outside – or at least only constant light. It is obvious that a place close to windows should be avoided. After all, the light conditions at sunrise are quite different from those at night, for example. The reliability of the system also in-

cludes regular maintenance. A brief glance by the technical staff at the camera system allows a statement to be made about possible contamination that would impair the inspection program. Before commissioning and program creation, the mechanical function test of the x-, y- and z-axis must be performed. For THT inspection, it is usually sufficient to inspect in a fixed x/y-level, as all solder joints are located on the bottom side of the PCB. However, it may happen that printed circuit boards are produced in a frame carrier, for example, or that a polarity has to be inspected at a different z-height. Therefore, it is possible to position the entire camera head with an accuracy of tenths of a millimeter. An optical visual check reviews the telecentric lens, the three illumination rings and the eight side cameras. Everything is protected from dirt by a glass pane.

With AOI, it is important to ensure a literally crystal clear view. However, the heart of the AOI, the telecentric lens, can only be cleaned with compressed air so that the special surface coating is not damaged. After cleaning with pure alcohol, the glass pane is subjected to a visual check to ensure that no solder balls, flux residues, dust or paper fibres are left behind.

The telecentric lens is an outstanding feature of the AOI. It ensures that no parallax occur, i.e. an ostensible change in the position of the component on the circuit board. This parallax effect increases the further away the component is from the center towards the edge.

Visual check of the glass pane – crystal clear view!



The image section, in this case called "Field of View" (FoV), can be fully exploited thanks to the telecentric optics without the described shifts occurring. The VERSAEYE operator benefits from this because as many components as possible can be inspected with one FoV on the basis of this information. The image size of a single FoV is then approximately 38.5 x 38.5 mm. The first time a program is created with the focus level defined, it is often the case that different operators enter a different z-value for the focus point. This is due to the different visual acuity of the respective persons. It therefore makes sense to have the focus level determined by an autofocus of the camera system. To get a new operator enthusiastic about VERSAEYE at this point – it is programmed completely without coordinates. Of course, it is also possible to quickly create a program with the CAD import option. However, this is only recommended for an inspection program with SMT components, since information such as rotation angle and mirroring have no significance for a THT solder joint. Information such as pad and hole size is important here, which do not appear in the coordinates of the CAD file, however.

#### POSITIVE IMAGE OF THE PCB

For this reason, there is a simple procedure for program creation. Two different methods of image processing are possible for the inspection. The first one is "Pattern Matching". A positive example of an image is memorized, and the system then searches for exactly this image on every further printed circuit board. If the memorized image is found, the inspection result is "good". This works

reliably with SMD assemblies, but has a serious disadvantage with THT solder joints: SMD components always have the same geometry and dimensions of the same body. With a THT solder joint, on the other hand, the pin can move freely depending on the hole diameter and is normally not centered. Therefore, VERSAEYE provides a second possibility of image processing – the so-called "histogram", in which colored pixels are searched for in an inspection area determined by the operator. Tolerances for image processing can be narrowly set for the histogram and are therefore not based on memorized images, but on a condition-oriented decision. If there are enough pixels in the selected tolerance range of a defined inspection area, the result is saved as "good". Irrespective of the direction in which the pin is located. A remarkable feature of the histogram is the 24-bit color depth, which reproduces a true-to-detail image and thus enables an extremely differentiated inspection.

#### OFFLINE CREATION OF AN AOI INSPECTION PROGRAM

For the first time, the inspection program is created using a non-populated and non-soldered PCB. Here all necessary information such as pad and hole size can be seen directly. After all tolerances for classifying the good or bad parts have been entered into the program, it is time for a first inspection run with a fully assembled and soldered PCB. Normally, the defects are reliably distinguished from the good solder joints without the need for tedious finding and reworking of the test samples. This saves time and nerves.



*Krisztian Kuzma during program creation on VERSAFLW 3/45.*

The program is created directly at the system. Practical experience shows that at high production pressure not so much time can be spent at the system. Therefore, a complete AOI inspection program can be created offline, completely without the system. This ensures that production is not delayed at any time.

The "good" and "NG" results of the inspection are sent to the customer via a possible MES connection and can then be viewed for tracking and follow-up processes. In any case, traceability via the repair workplace is possible. The DataMatrix code (DMC) is read into the software by a hand-held scanner and the associated result is retrieved directly from the database. The operator is most pleased about a "good", but even a NG (not good) is easily traceable. With the help of a crosshair, the operator is shown the position of the supposed error. The operator obtains a 360° panoramic view due to the special view of the eight side cameras. The fault is reliably located without having to inspect the printed circuit board with a magnifying glass.

## INTERVIEW WITH KRISZTIAN KUZMA

Krisztian Kuzma is chief engineer for the new production line with the integrated AOI and responsible for the smooth operation.

**Ersa:** Krisztian, after the five-day AOI training you can now operate everything (AOI, offline programming, repair workplace) independently – how do you feel about the operation?

**Krisztian Kuzma:** In my experience the hardware is robust, easy to maintain and seems to easily identify errors. I think it will help us a lot in the future. The software looks intuitive, which is confirmed by the programming. I understand how the system works – only the process of debugging is complicated at the moment. That will subside with increasing experience. It is also helpful that we have access to all data at all times when we have questions about the PCB later on. ■

*THT line with  
VERSAFLW 3/45  
and integrated  
AOI system.*



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