

Intelligent Camera Lens Assembly

with Active Alignment and a Single Optical Test Line for Different Products

About the Cooperation

In this project a fully automated assembly line including active alignment (AA) and test for intelligent camera modules was developed and deployed in multiple plants around the globe.

The customer was developing a new intelligent camera for a global OEM and was looking for a technical partner with strong optical know-how to develop a new alignment algorithm to achieve a faster cycle time and Konrad was the right fit for this task.



Project Scope

Challenges

- Main challenge was to achieve a stable process to reduce downtime to an absolute minimum. Automated camera production lines are complex machinery that is extremely sensitive to environmental factors such as dust, unwanted light exposure and mechanical misalignment as well as temperature.

Objectives

- The goal of the project was to develop an advanced active alignment process that is faster than all competitors in the market.
- During the project it was critical to stay flexible and to adapt to any upcoming challenge: The production line under development had to be flexible enough to accommodate future and different types of camera modules without updating the complete production line, among them were front facing ADAS cameras as well as driver monitoring cameras.
- Production and test process integrated together to reduce the cycle time (CT).

Solution

For the camera module assembly 6 fully automated stations were developed: Loading/Unloading, Plasma, Dispensing, Alignment, Oven, Optical Tester. Each station has its dedicated functions:

Loading:

- Loading of Lens and PCB board (DUT)

Plasma:

- Surface Activation with Openair-Plasma on PCB board and Lens

- Fixture in cleaning station: Taifun cleaning
- Bright/dark test, testing for defects on the DUT, the imager chip or on the lens

Dispensing:

- Dispensing the glue onto the lens or to the PCB board considering gluing points
- 3D laser measurements to check glue quality
- UV light to cure the glue

Alignment:

- Ensuring correct position in the fixture and scanning
- Ensuring correct Lens and PCB board via ITAC
- Connect DUT under the collimator/lens: active alignment process
- UV light to cure the glue and loading of tray

Oven:

- Heating of DUT in oven to finalize camera assembly

Optical Tester:

- Optical tests after heating process finalized and cooling to the room temperature
 - MTF test
 - Debris test
 - and other optical tests to control the quality

Unloading:

- Unloading of OK parts to the tray that is user-defined.

The line was developed for automated assembly, gluing, alignment, heating, plasma, optical testing, calibration and is a fully automated chain from assembly to optical test, from parts to OK DUT.

The FCT, optical test stations consist of max. 5 steps.

Up to 5 lines had to be produced in parallel and installed in several regions while adhering to a strict timeline.

Customer Benefit

- We worked together with the customer to develop a more robust and faster alignment process. At the same time we developed the core piece of the active alignment station and the optical tester to allow changeover for different camera types to increase the flexibility of the line to meet the needs of more car manufacturers more quickly.
- Initially, a 10-15 % improvement in cycle time was targeted. Finally, the improvement was up to 40 % in comparison to previous camera assembly lines, while the footprint was reduced by 20 %.

Our Know-how

Konrad started to develop camera assembly lines for the consumer market in the early 2000s. The extremely fast pace of this market as well as the challenging time requirements led to an innovative solution approach that is optimized for maximum speed and modularity.

Camera assembly is a very complex and sensitive process. Slight variations in temperature can already cause issues in the final product so everything needs to be carefully calibrated and controlled to ensure the highest quality of camera modules are produced.



Camera Lens Assembly with Active Alignment and Optical Test Line

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