

# High-Precision Alignment for AR Consumer Device

A solution of 15 micron alignment accuracy yields dramatically improved customer experience

## Challenges

- Requirement for +/- 25 micron repeatability

## Key Automation Capabilities

- Precision Alignment
- Precision Adhesive Dispensing
- Non-Marring Material Handling

## Solution

Jabil Precision Automation Solutions was able to exceed all the customer's requirements by delivering a robust automated solution that provided dispensing, alignment, and inspection capabilities for their augmented reality device.



### Dispenser Station #1

Dispensing capabilities played a key role in retaining the alignment of the optical elements which allowed the system to deliver finished assemblies aligned to specified tolerances.

The first dispensing station integrated a high-end vision system which featured a 26MP camera and high-resolution telecentric lens. This setup allowed the system to precisely locate the position and height of the optical elements. Adhesive material was dispensed onto tightly controlled locations on the optical elements.

### Aligner Station

The most crucial step of this procedure

is the precision alignment process that takes place at this stage. To ensure the proper functionality and performance of the final product, the substrates must be accurately aligned because misalignment of the materials will result in poor performance and costly, unnecessary production setbacks.

The alignment process begins by clamping the optical element in place against kinematic features within the assembly. Custom tooling and cameras were developed and utilized to locate the product's fiducial features which defined the substrate's X-Y location.

Parallelism of the substrates is a key factor in the alignment process, so

to ensure the customer's specified tolerances were met, Jabil Precision Automation Solutions utilized a patented planarity adjustment tooling system.

This tool implemented a 12-axes coordinate motion system that adjusted and corrected the substrates' pitch and yaw orientations to ensure precise positioning. With this custom solution in place, we were able to deliver +/- 15 micron accuracy performance for our customer.

Once substrates were properly aligned and in the correct orientation, a custom-engineered ultraviolet (UV) curing system tack cured the substrates

in position. This secured the substrates in place before advancing to the next process station.

#### Inline Inspection System

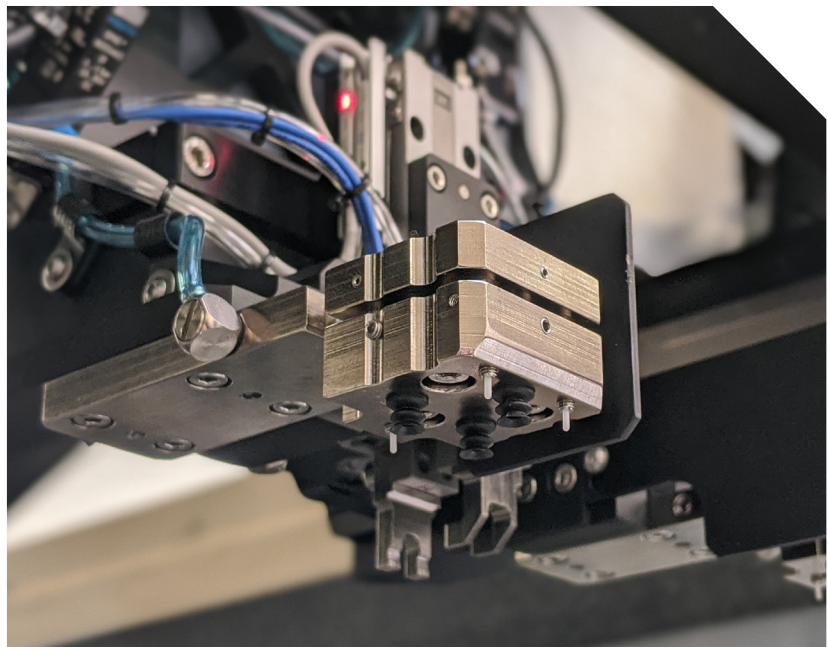
To ensure the proper alignment of the substrates, an inline inspection line was integrated into the system to help verify whether the sub-assembly met the customer's acceptance criteria. The system combined 2 high-resolution cameras that were used to inspect the assembly's features for actual substrate alignment. During the inspection process, x-y measurement data is collected by inspection system and compared to user defined acceptable tolerances. An autocollimator inspects the substrate to determine the pitch and yaw values of the assembly alignment.

This allows the system to determine whether the sub-assembly meets the acceptance criteria and provides the specific measurement data for the customer's device characterization. The data values are recorded by the Manufacturing Execution System (MES) for future reference and process optimization.

#### Dispenser Station #2

Lastly, a jet dispensing system dispenses an adhesive fill material along specified parameters of the assembly to help further secure the optical elements together. The assembly is then advanced to the final UV cure station where the substrates are permanently secured. The completed sub-assembly is now ready for assembly into the AR device.

"We developed a fully automated solution designed to automate the handling, precision alignment, and assembly of the key optical elements."



## Results

- **40% increase** in optical assembly repeatability yields dramatically improved customer experience