

# CASE STUDY

# OPTICAL BONDING

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A ROBUST UNIT – HIGH-QUALITY DISPLAYS  
THANKS TO OPTICAL BONDING



## Fact check

- Cycle time: 60 seconds
- Highly parameterizable bonding process
- Integrated Line-Controller
- Performance monitoring and derived optimization measures



## PRECISE MANUFACTURING TECHNOLOGY FOR PREMIUM HOME APPLIANCES

### INDIVIDUAL COMPONENTS PERFECTLY COMBINED

Anyone who has ever operated a washing machine, vacuum cleaner or even a steam cooker knows that top-of-the-line household appliances are not only characterized by quality and durability, but can also usually be operated intuitively and reliably — often using touch displays. They provide high-contrast information with high color brilliance and respond extremely precisely. This is made possible through optical bonding, a process that joins the outer glass panel to the touch glass behind it. The automation specialists at PIA Automation have already developed and built several optical bonding systems for their customers.

Anyone who buys premium items expects top-of-the-line goods that feature the best performance, excellent quality, and simple, intuitive operation. This applies to new vehicles just as much as it does to smartphones or even household appliances. The control units of such top-of-the-line devices must meet the highest standards. The process by which the glass surface of the control unit is bonded to the touch glass behind it has a crucial impact on operation, color presentation, readability and the overall quality of the display.

Many premium manufacturers therefore rely on optical bonding for their operating units. Displays manufactured in this way are used in various industries, such as the household appliance industry, in electronic products, and also in vehicles. The decisive difference compared to other processes: A bonding fill compound is applied between the glass panel and the touch glass behind it, which is distributed evenly between the components, eliminating air pockets along the way. The fill compound fills the entire space between the glass panel and the touch glass, while in other processes, a gap remains between the two components. This can, for example, make operation less precise, and result in disturbing reflections or poor legibility, especially outdoors. Consequently, experts often refer to optical bonding as “the highest form of bonding”, and for good reason.

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Our customers are convinced by our in-depth know-how in the field of optical bonding. However, every project is different, and the requirements in the premium segment are consistently high.

Bastian Uhlig, Head of Sales at PIA Automation Bad Neustadt



## THE PROCESS: QUITE COMPLEX

PIA Automation is currently reliably operating several optical bonding lines for different industries. "Our customers are convinced by our in-depth know-how in the field of optical bonding," says Bastian Uhlig, sales manager at PIA Automation Bad Neustadt. "However, every project is different, and the requirements in the premium segment are consistently high." These include, for example, absolute precision and a high level of repeatability, fast cycle times and consistently excellent quality. But with optical bonding, it is not enough that all process steps are carried out with the highest precision. Ambient conditions such as temperature or humidity also have a direct impact on the quality of the end product. Systems by PIA Automation are therefore designed to be operated in a clean room.

Numerous steps are necessary before the control units manufactured using optical bonding can finally be further processed at the customer's premises.

**To accommodate these steps, PIA's systems consist of several cells:** The operating units for household appliances, for example, usually enter the pre-processing cell equipped with a protective film.

- 1 An ESD-compliant (electrostatic discharge) robot removes this protective film from the touch glass.
- 2 This is followed by the so-called plasma activation of connecting parts. On such parts, the electronics with the display are later applied behind the operating unit. The plasma, an ionized gas generated by an electrical generator, activates the surfaces of these components so that they adhere optimally to the glass panel.

## THE RESULTS: REMARKABLE

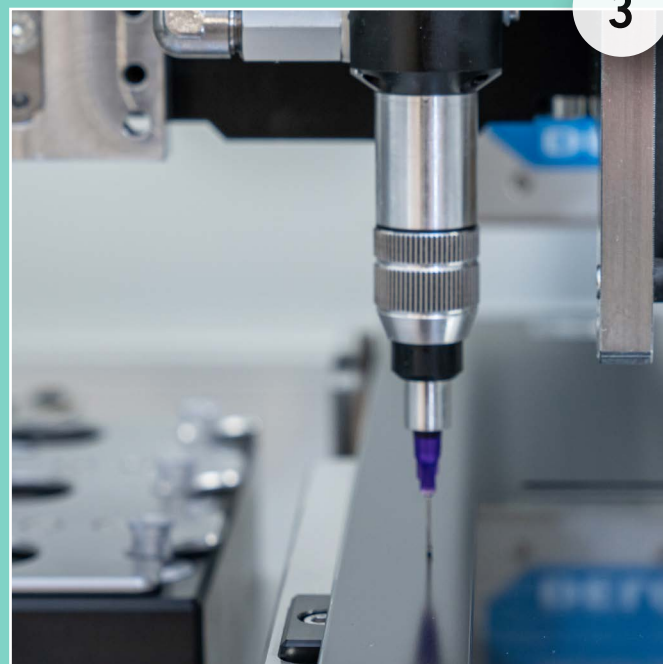
The cycle time of the stations of such components for household appliances is only one minute. The systems can run in three-shift operations. Component after component, they provide absolute precision and high quality.

Displays manufactured with optical bonding are significantly clearer and more color-intensive than displays bonded with other processes. They are also less susceptible to reflections from external light sources. Also, no particles or moisture can get between the components. In addition, displays manufactured in this way are more robust — the panel, dispensing materials and touch sensor form a robust unit that is highly resistant to vibration and impact.

In addition, PIA offers a solution in which the individual production steps are monitored in the process, making it possible to immediately readjust them if necessary. This is a unique selling point that has already convinced many customers.



Customers have an overview of the entire process at all times via PIA's integrated line controller. The data-based master computer system for controlling production processes records all important process data and makes it clearly available in a visualization and user interface.

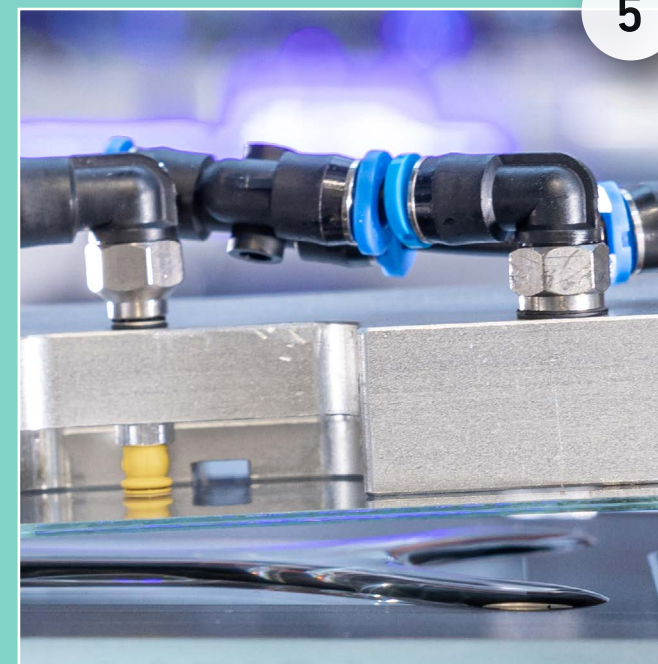


In the next cell, the dam is applied, a highly viscous protection around the part of the touch display that will be visible in the final product. It acts as a barrier for the filler, which is applied in the following cell.

The height of the dam is crucial for the later success of the optical bonding. That is why PIA has integrated intelligent tools that automatically measure the height on the glass screen so that the dam can be applied in a path-controlled manner, at a constant distance from the glass surface and in perfectly dosed. The dam is then cured under UV light.



The next cell lies at the heart of the system: the actual bonding cell. Here, the bonding fill compound is added onto the so-called active layer, which is the part of the display visible to users. The technology that PIA Automation is increasingly using for dispensing comes from Viscotec. The company, based in Töging am Inn, Germany, supplied the dosing units that dispense the materials onto the touch glass in the exact amount and viscosity required. "We really appreciate Viscotec's solutions and have already successfully implemented several projects together," says Uhlig. PIA and Viscotec plan to further expand their cooperation.



For a perfect bonding result, the glass panel and touch glass must be joined in a plane parallel position after the bonding fill compound is applied.

Measuring systems in the PIA systems automatically detect exactly where the active layer is located. Based on these measuring points, the position of the component can be aligned as required using two spindle drives underneath the workpiece carrier. The touch glass is then precisely applied to the glass panel, and the filler is cured with UV light in the next step.



In the last cell of the optical bonding systems by PIA Automation, the connecting parts are attached to the glass panel. The electronics with display will later be connected with the glass panels using the same systems. A gripper system takes the parts from a workpiece carrier and places them on the prepared glass panel.

After another round of UV curing, the process is complete. This is followed by a visual inspection by experienced machine operators, after which the operating units are placed in a transport container and ready for further processing.

creating efficiency.

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We make high-quality products available to everyone – sustainable and worldwide – that is what we stand for at PIA.



Austria. Canada. China. Croatia. Germany.  
Mexico. USA.