

# Optical bonding of displays – a must have for your application?

Optical bonding has established itself in industry and medicine and is a technically mature method of HMI display optimisation. Using different bonding technologies, cover glasses with touch sensors and displays are bonded to form a single unit. Optical bonding of displays significantly improves and optimizes the optical and mechanical performance characteristics of input systems for the application.

But do you know the bonding possibilities and their advantages?



## Criteria for selecting the appropriate bonding technology for HMI applications with display

The correct selection of the most suitable bonding technology for your application is based on the application requirements. Determining factors are the specified environmental influences, the display shape and diagonal as well as the definition of the PCAP sensor technology.

### Outdoor display applications

Touch panels and display applications in outdoor areas are subject to strong temperature fluctuations. Extreme temperature changes can occur at night when temperatures are below zero and during the day due to sunlight. Condensation on the surfaces occurs when warm and humid air meets cold surfaces such as the display and front

glass. Warm air can absorb more water vapour than cold air. On contact with cold surfaces, the water vapour condenses and forms condensation moisture.



control unit in outdoor use

If there is an air gap between the display and the front glass with touch sensor, moisture can be deposited on both surfaces due to condensation. This condensation moisture leads to negative impairments of the screen display. Preventing condensation would be

possible if the internal temperature of the application is kept constant. A simpler and safer solution is to completely fill the air gap with optical bonding material.

For outdoor applications with daily exposure to sunlight, only UV-qualified bonding materials and components are used. This means that permanent UV radiation does not have a negative impact during the lifetime.

### Display applications in the industrial and medical sectors

The readability of a display depends not only on highly transparent PCAP sensors, but also on the incident light of the environment.

The light radiation is refracted and reflected by the air gap between the surfaces of the display and the cover glass with sensor. The filling with optical bonding material bridges this air gap.

Thanks to optical bonding, the screen content is emitted to the front without reflection. The bonding material has a refractive index comparable to that of the glass. This means that no more reflection or refraction can occur. In addition, bonding increases readability due to the increased contrast and enables a glare-free screen surface. Especially for medical applications, high contrast is indispensable for visualizations in diagnostics. Optical bonding also increases robustness and improves resistance to shock, vibration and increased force. Another advantage is the heat dissipation from the LED backlights and the display surface via the bonding material to the cover glass. This heat dissipation increases the lifetime of the LED backlight due to the temperature reduction.

Optical bonding is therefore the optimal solution for all medical devices that require perfect readability.

## Display applications in portable devices and vehicle construction

The mechanical reinforcement achieved through optical bonding results in a much more robust system. This is particularly advantageous for portable and automotive applications. The fixed connection of the cover glass via optical bonding provides shatter protection in case of glass breakage.

The elimination of the air gap between the cover glass with touch sensor and the display prevents dew formation between the two components in outdoor applications. In addition, the penetration of dirt or liquids is prevented. The mechanical fixation of the displays by optical bonding eliminates the need for mounting brackets, which leads to a reduction in the weight of portable devices.

## Which optical bonding process is suitable?

There are several technologies available for optical bonding of displays. The optimal process depends on the choice of components, system integration and application requirements.

- **Dry Optical Bonding:**

In dry bonding, the bonding material is cut to the size of the visible display surface and the air gap is filled homogeneously with it. There is a choice of several bonding materials in different thicknesses and consistencies, which are selected on the basis of the displays and the specifications

of the application. Displays have different heights of metal frames depending on the model and diagonal. The optimum material thickness is determined on the basis of the displays. The front glass with touch and display are joined together under vacuum in the bonding machine.



Dry Optical Bonding

- **Liquid Optical Bonding (LOCA):**

A UV-curable liquid material is used to fill the air gap between the display surface and the back of the sensor or cover glass. The adhesive is silicone-free, ageing-resistant and UV-stable. The process is suitable for all TFT displays with or without frames. The liquid bonding material is dispensed onto the display surface in a special pattern and the cover glass with sensor is bonded using controlled surface pressure. Then, the bonding material is distributed evenly and bubble-free between the two components. The bonding material is then cured by means of UV light without additional heat storage, i.e. there is no material stress due to the effect of temperature and thus no mechanical stress.



Liquid Optical Bonding

With both technologies, a special pre-treatment is carried out to increase the bonding strength of the bonding material on the surfaces of the joining partners. This ensures a strong bond between the different materials. The bond is so strong that the bonding material firmly fixes the display mechanically and no further mechanical screwing is necessary.

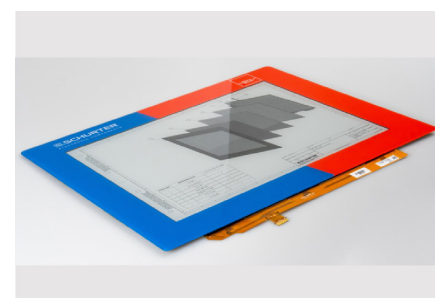
- **Air Gap Bonding:**

In this simple process, the display is firmly bonded all around with an adhesive frame directly behind the cover glass with sensor in the clean room. However, an air gap remains between the front glass with sensor and the display. Air Gap Bonding is a simple and cost-effective way to connect displays with cover glasses or touch sensors without further mechanical fixation.

## Special feature of optical bonding of e-paper displays

The properties of e-paper displays always require additional mechanical protection during integration. Stability and robustness can only be achieved through full-surface bonding via optical bonding with a cover glass. Here, too, the choice of bonding material is defined on the basis of the components and environmental conditions of the application. Different protective glasses with frame printing, touch sensors and plastic panes are used here.

Compared to the optical bonding of TFT LC displays, the processes for the extremely thin e-paper bonding are considerably more demanding and irreversible. E-paper displays require additional illumination in the dark. This is realised by a special structure with highly transparent adhesives and a light guide material. The light from LED strips is coupled in laterally and distributed homogeneously over the surface of the display via the build-up layers. This illumination option enables the readability of e-paper displays in the dark.



bonded e-paper

## **Bonding competence at SCHURTER**

Optical bonding is the optimal solution for applications with high requirements and challenging fields of application.

All bonding processes are carried out in special clean rooms with a high degree of automation and standardised processes. Benefit from the different bonding technologies and our know-how for the optimal solution of your customer-specific application.

## **About SCHURTER**

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SCHURTER GmbH  
Elsässer Straße 3  
79346 Endingen am Kaiserstuhl  
Deutschland  
+49 7642 6820  
[info.de@schurter.com](mailto:info.de@schurter.com)  
[schurter.com](http://schurter.com)