Planar® LookThru™ OLED Transparent Display
Frequently Asked Questions

1.   How does the transparent OLED technology work?

OLED is a flat panel display technology which has been in development for decades. OLED (Organic Light Emitting Diode) technology was first reduced to practice at Eastman Kodak in the early 1980s. The first commercial, limited production OLED displays were sold in 1997. Since then these displays have found use in car stereos, MP3 players and cameras, but by far the largest market for OLEDs to date has been smart phones where under the radar over *half a billion* have been sold. In the past few years a limited number of full HD panels at 55" and larger have become available, where the duty cycle is limited and the risk of burn-in from static content is minimized. The term "organic" doesn't imply these displays are pesticide free or made from naturally-grown products; rather it refers to the fact the semiconducting materials used to fabricate the light-emitting diodes are carbon-based.

Each "pixel" of this transparent OLED display is made up of four segments. The largest is a clear segment, allowing for transparency. The others are color segments for red, green, and blue.

2.   What are the benefits and limitations of OLED in general?

OLED is a very promising technology. It is not yet ready for mainstream display and video wall use in commercial environments, but we are watching it closely and working on it in our labs.

The benefits of the technology are wide color gamut, viewing angle, contrast ratio, power usage (with typical video content), and thinness. As a core technology, OLEDs promise to be thinner than LCDs, have faster refresh rates, and can be produced on flexible plastic substrates for durability, weight, and clever mechanical designs.

The downsides are generally cost, commercial availability, and lifetime. As a data point, the cost for a LED-backlit LCD TV is one-quarter (or less) the price of an OLED version in the same diagonal. OLEDs are prone to image retention and static content should be avoided. The overall lifetime of the display is diminished as organic materials degrade. For commercial flat panel applications where 24x7 operation is desired, we recommend the range of Planar's other flat panels displays.

3.   What are the use cases that customers should be envisioning for Planar LookThru OLED?

We see a variety of use cases being made possible using this technology that were previously impossible or highly limited. Some ideas are listed below:

- *Museum exhibits*: Display background information, video, or explanatory text about artifacts behind the glass (without risking UV exposure to delicate or priceless artifacts as might occur in a display box).

- *Retail merchandising*: Put transparent displays alongside products for sale in a retail environment for a richer customer experience. The merchandise itself is not unduly obscured by the display and remains readable and accessible.
- *Assisted shopping applications*: Use the two-way nature of the transparent OLED display to present information to a potential buyer, triggered by a sales associate behind the display. Merchandise itself could trigger content using camera sensors or tokens.
- *Wayfinding*: Use the display in a public space to locate shops, train schedules, or restaurant menus, while maintaining visibility throughout the space, which is an important safety consideration.
- *Meeting space*: Use the glass panels or windows that might surround a conference room or informal meeting space in a corporate environment as a display surface. For presentation within the space or to display meeting information outside the space.
- *Video art applications*: Create interactive or dynamic art pieces using video, motion graphics, and other materials.

4.   **What about touch? Can Planar LookThru OLED displays be outfitted with touch sensors for interactivity?**

The Planar LookThru OLED offers a 32 point IR touch system as an option in both product configurations. Integrators may integrate their own touch or gesture interactivity into their system designs using our standard display.

5.   **How is OLED different from direct view LED video wall technology?**

While both employ their own flavor of light emitting diodes, there is a lot of difference between OLED technology and the direct view light emitting diode (DV LED), like those used in highway billboards or Times Square marquees. DV LED is made up of circuit boards populated with discrete, surface mount inorganic LED packages, one package per pixel. The surface of an OLED display is a glass or plastic, not the texture of pixels mounted to circuit boards.

6.   **Why doesn't Planar offer a 4K or UHD resolution version of Planar LookThru OLED?**

There is a direct relationship between transmissivity (the perception of transparency) and resolution. The more pixels that need to be displayed on the screen (in their RGB sub-pixels) the less space there is available for clear sub-pixels that viewers can see through. So, the full HD resolution of the planned product optimizes the image clarity and transparency in the 55" size. As the technology develops, we expect improvements in this that might make a 4k display possible, but nothing is being planned in the next 18-24 months.

7.   **How can customers extend the life of their panels, as OLED is expected to not have as many hours of lifetime and be more sensitive to burn-in than equivalent LCD displays?**

Customers can directly affect the lifetime and image performance of their displays by their content selections. Content drives both power usage and life-time. The more pixels are at rest (read: black content) the less power is consumed, the longer those pixels will last, and the more transparent the display. Lifetime is related to ours of life for each pixel, so we encourage customers and their agencies and content developers to keep the content mostly black and keep it active. We HIGHLY advise against static content (ie, text, maps, static logos, desktops, etc). Even error messages, operating system update menus and the like should be disabled to avoid inadvertent burn-in.

8. **How can customers maximize the perceived transparency of the display? Under what conditions are the display the most "clear"?**

    Just like any clear piece of glass, the ambient light will greatly affect the perceived transparency. The windows facing into a dark room will appear opaque and when the light is bright within the rooms of a house, the windows suddenly appear clear. The same applies to a transparent display. If you place objects or scenes behind the screen and keep them in the shadows, the image on the face of the display will appear more opaque (drawing the eye forward to the content on the screen). The same scene, when well lit, either with uplights or downlights, will suddenly draw the viewer's eyes to the background, through the display screen.

    This leads to great opportunities for orchestrating ambient lighting with screen content to create different customer experiences, drawing their eyes forward and back to tell a story in 3-dimensional space.

    Of course, each individual pixel will only appear transparent if the pixel isn't lit with bright or light content, so lots of black content on the screen is advised. When Planar develops content for demonstration, we prefer each screen having 75% black content visible at all times, to show off the transparency.

9. **Is it possible to read text or see product details through the display?**

    You can read text down to 10 or 12 pt within a few inches of the display and see larger signs from dozens of feet away. Book titles, logos on products, and even details on watch faces in a display case will be quite visible. There is a prominent pixel structure visible when you get up close on the display (appears to be a small screen door effect), so it isn't as uniform as tinted glass or acrylic and it isn't as clear as regular tempered glass, but for retail merchandising, museum exhibit display, and the like the transmissivity should be adequate.

10. **Can the displays be tiled to create transparent video walls**

    The Planar LookThru OLED display is a 55" monitor, not a video wall solution. But just like any monitor in our line-up, the display can be tiled to create video walls with mounting solutions and the use of a processor, like Planar's Clarity® Visual Control Station™ (VCS™) Video Wall Processor, each output of the processor powering an individual display. The Planar LookThru OLED 55" displays have three small bezels (4mm of inactive area) on the top, right and left hand edges. The bottom edges has a black bar (behind the smooth Gorilla Glass surface) of approximately 3". As a result of this bezel un-uniformity, we recommend video walls that are 2 high in landscape or 2 wide in portrait. They can be any width or height in those configurations. You will see examples of lots of video wall configurations in the inspiration gallery images that we will share at launch.

    For integrators to achieve these installations, they will want to work with a credible fabricator (in the form of an exhibit design or fixture maker, most commonly) to create the structure unique to their needs. They could go to someone like RP Visual Solutions, a fixture maker like one of the ones assembled by the publishers of design: retail (http://buyersguide.designretailonline.com/category/fixtures), or a trade show exhibit design and build firm (which are in nearly every city).

11. **What does the back of the display look like?**

   The Planar LookThru OLED has nearly a 360 degree viewing angle. Because it doesn't require a light box behind the display, the content on the screen is visible from the back at a reduced brightness and perceived contrast. Our observations reveal about 25% less contrast on the back then the front of the display which still results in a visible image. And because the display is emissive, the viewing angle is exceptional from all sides.

12. **Can the Planar LookThru OLED be used in outdoor or direct sunlight applications?**

   Planar doesn't recommend the use of the Planar LookThru OLED in outdoor or direct sunlight due to the adverse effect UV exposure has on the OLED material lifetime. But please contact Planar to discuss your specific application.