crystalscreen

UNITED SCREENS GMBH future display technology

Content Developer's Guide

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How transparent OLEDs work

History of OLEDs

OLED is a flat-panel display technology that has been in development for decades and is unbelievably promising as display technology. The OLED (Organic Light Emitting Diode) technology was first introduced at Eastman Kodak in the early 1980s. The The first commercial OLED displays were sold in 1997 in limited production. Ever since then, these displays found use in car stereos, MP3 players and cameras, but the is by far the largest market for OLEDs is that of smartphones, where the radar has so far been using a half a billion of these displays were sold. For a relatively short time now, a limited number of of 55 „Full-HD panels, where the risk of burning in static content is reduced was minimized.

The term „organic“ does not mean that these ads are pesticide-free or made from natural grown products. Rather, it refers to the fact that the information submitted to the production of the light-emitting diodes are carbon-based semiconducting materials used.

OLED is a promising technology. The advantages at a glance:

- wide colour gamut
- large viewing angle
- good contrast ratio
- low energy consumption
- low construction depth

OLEDs are thinner and lighter in their core technology than LCDs, and have faster image refreshrates and can be produced on flexible plastic substrates.

Pixel structure

Each „pixel“ of a transparent OLED display consists of four segments. The largest is an empty segment, which allows transparency. The others are color segments for red, green and blue. This structure is quite clearly visible when you e. g. use the magnifying glass function of your mobile phone camera right in front of the display.

There is a direct relationship between transmissivity (the perception of transparency) and resolution. The more pixels are displayed on the screen (in their RGB subpixels), the less space is available for transparent subpixels that can be viewed through. The Full HD resolution of the Crystal Screen OLED display optimizes the balance between sharpness and transparency in the 55 inch size.

Content Development

Differences between transparent OLED and conventional LCD Eisplays

Conventional LCD displays are structured in such a way that the permanently switched on backlight can be closed by electrically charged liquid crystals in order to either let the light through or block it. The combination with a color filter generates the images on the display. Most LCD displays are not transparent.

OLED, on the other hand, is an emission technology! This means that each pixel lights up independently, eliminating the need for backlighting. In a transparent OLED display, inactive pixels are transparent (up to the point of the transmissivity of the display).

Differences to transparent LCD displays

Transparent LCD displays work in the opposite direction to T-OLED displays. On a transparent LCD, white pixels are transparent and black pixels are opaque. This is similar to the principle of old overhead projectors or slides. This means that no floating white text can be displayed on a transparent LCD display on a transparent background. Similarly, you cannot display black text on a transparent OLED on a transparent background.

Seeing Black

Black pixels on a transparent OLED display are transparent. The picture on the right shows this effect clearly. The background in the WHITE area in the middle of the display is completely black.

Dark grey or other gray tones are different from black and can be displayed as shown in the gradients on the right.

Fullscreen images and videos can also be displayed, with colour-intensive content being particularly brilliant. However, you will notice that large dark or black areas appear transparent. Smaller dark/black areas, on the other hand, are not necessarily perceived as purely transparent, but still as black. This phenomenon is simply due to the ability of our brain to interpret.

Seeing white

As shown in the picture on page 2, you can use a Crystal Screens T-OLED to display floating white text or images.

Highly saturated colors

Crystal Screens T-OLED displays show an outstanding color performance, which is best seen in highly saturated colors.

Visualization help for presentations

Often designers are asked to create visualizations or presentations of a Crystal Screen T-OLED column on site.
Our CAD drawings on united-screens.tv/downloads are an important resource for preparing these mock-ups. The next question frequently asked is how to convincingly present content on the T-OLED display (mock-up) or how this content looks on the display.
With the following advice you should be able to create a convincing mock-up:

- If you are using a static photo, remove all black or dark areas in Photoshop (or any other editing program) and make this area transparent.
- If you are using a vector image, start with a transparent background.
- Alternatively, you can set the layer with the T-OLED image or video to 55% transparency, duplicate this layer and then set it to the Layer Blending Mode Screen (negative multiply). This is the most accurate representation. Eventually further adjustments / improvements are necessary to get an appealing presentation. In this case, experiment with the contrast and gamma settings of the image.

Transparency considerations

Transparenz-Maximierung mittels Inhalt

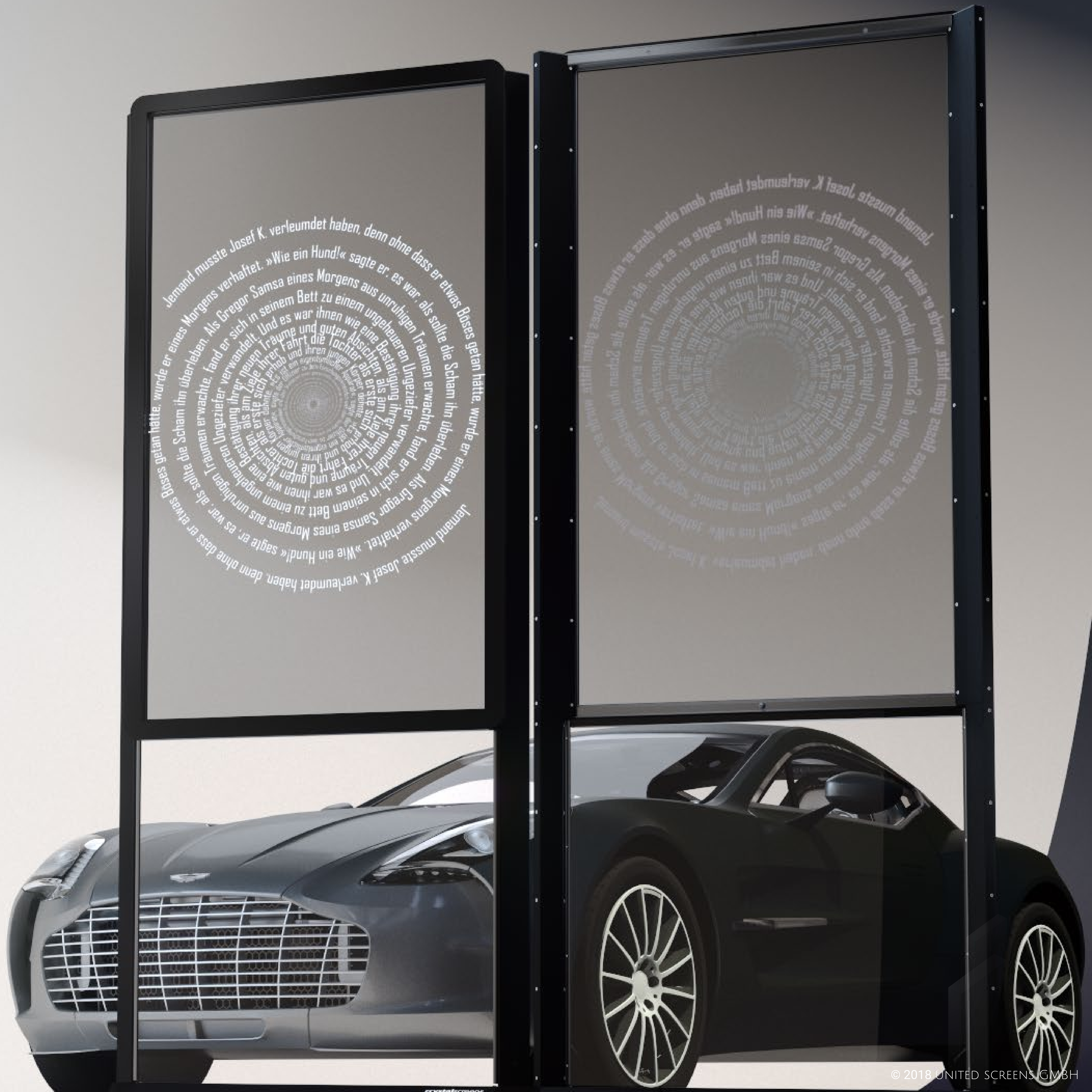
Each individual pixel is only displayed transparently if it is not illuminated.
Therefore, we recommend to use large black or dark areas in the image to reach a high degree of transparency. When developing content for presentations, we prefer at least 50-75% black content to emphasize transparency. The decisive factor here is that the percentage value applies to the black area surrounding the content and not to dark or black areas within the actually visible content (e. g. dark shade/shadow or black hair).

Adjustment of transparency by lighting

As with conventional glass, ambient light strongly influences the perceived transparency of the T-OLED panel. Building windows with a dark room behind them appear opaque, but when someone turns on the light they suddenly appear clear and transparent.
The same applies to transparent displays. If you place objects or scenes behind the display and they are in the shadows, the image on the front of the display will appear less transparent (the eye will be directed more towards the content on the display).
The same scene, well lit, will suddenly pull the viewer's eyes into the background, through the screen. This opens up great opportunities.
By matching the backlighting and display content, different scenarios can be created in which the eyes move back and forth between the display and the background, giving content a 3-dimensionality.

Seeing Through the Back of the Display

Due to the missing backlight behind the display, contents are also visible on the back of the screen, but brightness and contrast are reduced. Contrast and brightness reduction is about 25%.



Remarks on the display Lifetime

Static and moving video images

The display lifetime refers to the hours of life of each pixel, so we encourage customers and their agencies and content developers to keep the content predominantly black and moving.

Please do NOT use static content (e. g. static logos, desktop menus, etc.).
Error messages, operating system update notifications and the like should also be deactivated to avoid unintentional burn-in.

The time to burn in depends on the brightness of the static image or repeated video pattern. The worst or fastest burn-in is achieved with white or blue against a black background.
For example, a video clip with an average luminance of 150 nits could burn in after 1000 hours. In a clip with an average luminance of 70 Nits (most of the screen is black) you could only see a burn-in after 2200 hours.

Accumulated Stress

The life span of the display is the accumulation of the life span of each pixel. This means that even if areas of a content move, as soon as they are always in the same place on the screen (e. g. small, rotating company logo in a corner), these pixels become much more stressed and contribute over time to the permanent burn-in in this area.

Other factors impairing the service life

If the display is operated at elevated temperatures (over 35° C), this will affect the life span of the display as panel materials age more quickly at high temperatures. The panel is then more exposed to burn-in.

Impressum

Manufacturer name: United Screens GmbH

Manufacturer Address: Behringstraße 28A, 22765 Hamburg, Germany

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