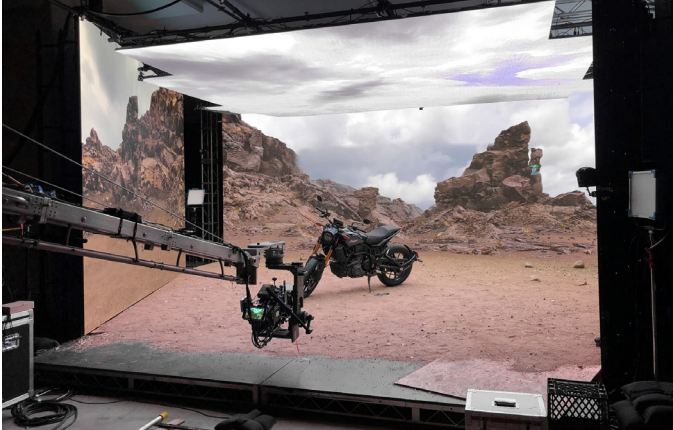


LED Screens - Virtual Production



Virtual Advancements

Virtual production has advanced rapidly, driven by the success of Disney's *The Mandalorian* and the impact of COVID-19 on film and live events. XR is now a leading virtual production solution for film and broadcast. Our aim is to provide a clear, practical overview without unnecessary technical jargon.



Virtual Production – Efficient Working Method

One significant distinction between virtual production and traditional green-screen techniques is that tasks once reserved for post-production have shifted into pre-production and even onto the set. This shift reduces the need for time-consuming and expensive post-production clean-up. Although building a virtual studio and crafting virtual backgrounds requires substantial initial investment, many tasks that formerly occurred in post-production or on location can now be handled within the virtual studio, yielding a faster and more efficient workflow.

Live LED Wall In-Camera Virtual Production

Using imagery generated by real-time engines displayed on live LED walls, combined with precise camera tracking to capture final-pixel imagery directly in-camera, represents the leading edge of virtual production. Projecting live imagery behind performers offers substantial advantages and reflects the culmination of prior advancements in the field. The key breakthrough is that real-time engine outputs—unlike rear-projected, pre-rendered footage—can adjust perspective dynamically. This produces synchronized parallax with the camera movement, resulting in imagery that blends seamlessly with the live action. The effect is remarkably realistic, often making it difficult to discern where the physical scene ends and the virtual background begins.

Virtual production depends heavily on advanced technology and a wide array of assets. Success in this field demands deep expertise across multiple disciplines, including LED systems, lighting design, camera operation, media servers, motion-tracking, and real-time visualization. To achieve consistently excellent results, it is essential to assemble a team that understands the full technical ecosystem and can integrate each component effectively.

Choose the right LED product

Panel Specifications Overview

Each LED panel is accompanied by several specifications that indicate its suitability for different applications. Understanding these specifications helps determine which panel will deliver the desired image quality and camera performance.

Pixel Pitch

Pixel pitch refers to the distance between the centres of adjacent pixels. It is a key consideration when selecting a screen because it directly affects viewing distance and camera capture. For close-up work or shots that include fine detail, a smaller pixel pitch is recommended. In current market demand, common pixel pitches range between 2.8 mm and 2.6 mm, with an emerging trend toward even finer pitches such as 2.3 mm, however in a studio environment would use max of 1.86mm, ideally 1.25mm.



Driver IC

The overall performance of an LED panel depends on the quality of the LEDs, the driver ICs, and the receiver card. The driver IC determines how LEDs are controlled, influencing factors such as capacity, scan rate, and achievable brightness. There is a balance between driver IC capacity, scan rate, brightness, and LED characteristics: using more driver ICs typically improves LED control and performance, enabling better brightness management and image fidelity.

Scan Rate

Scan rate describes how driver IC output pins multiplex multiple LEDs by completing each LED circuit sequentially. Within a single refresh cycle, every LED is illuminated once. Common scan rates include 16:1, 11:1, and 8:1. Panels with more driver ICs can operate at lower scan rates because they refresh smaller groups of LEDs at a time. Lower grouping refreshes are completed more quickly and are generally friendlier to camera sensors, producing smoother images with fewer visual artifacts.

Refresh Rate

Refresh rate is the number of times per second the display redraws a frame, typically specified in hertz (for example, 1920 Hz, 3840 Hz, or 7680 Hz). Low refresh rates can cause a visible or on-camera flicker, especially noticeable at lower grayscale levels where the effective refresh rate may drop to reproduce the gradations correctly. Higher refresh rates improve on-camera appearance and reduce flicker; however, if the refresh rate of the LED screen and the camera are far apart, the camera may struggle to capture a stable image. This mismatch is most problematic at low grayscale values when the screen's refresh dynamics change to render darker tones accurately. We always use 7680Hz for studio work.

Frame Rate

Frame rate refers to the number of frames displayed per second and is commonly expressed in hertz (Hz). Typical source frame rates include 24, 50 and 60 Hz. In cinematography many Directors of Photography (DPs or DOPs) prefer higher frame rates for action-heavy material because increased frame rates better capture rapid motion and improve on-camera performance for live-action shooting. Although modern LED displays can support high frame rates (for example, 120 frames per second), practical limitations often come from the content rendering pipeline rather than the panel itself. Rendering systems, playback hardware and data transfer can struggle to supply frames fast enough to fully utilize very high refresh rates. Nevertheless, most LEDsynergy panels are capable of operating at elevated frame rates when the rest of the workflow can keep pace.

Colour Gamut

Colour gamut defines the range of colours an LED panel can reproduce, typically represented as an area inside a colour triangle on a chromaticity diagram. A larger covered area indicates a wider gamut and the ability to show more vivid and varied colours, producing images that better approximate real-world scenes. Human vision can perceive colours beyond what most LED screens and camera sensors can capture or display.

Virtual Advancements

The broadcast industry has always been at the forefront of visual storytelling, constantly evolving to enhance the viewer's experience. Over the past decade, LED displays have become the go-to technology for studios worldwide. With the introduction of XR, Extended Reality, the options now open to the industry has widened beyond imagination.



Two primary factors affect an LED panel's colour gamut:

- **LED chip quality:** Higher-quality LED chips deliver improved colour performance—for example, deeper and more saturated blues. The LED chip is currently one of the most costly components in a display and is a major determinant of its colour reproduction capability.
- **Batch consistency:** Uniformity across LED batches ensures that, after colour calibration, most panels maintain strong and consistent gamut coverage. Better consistency reduces variance between units and simplifies achieving accurate colour across large installations.

LEDsynergy sources full, single LED batches to manufacture LED panels from the same batch, ensuring consistent colour characteristics. Their LED panels achieve coverage of up to 95% of the DCI-P3 colour space.

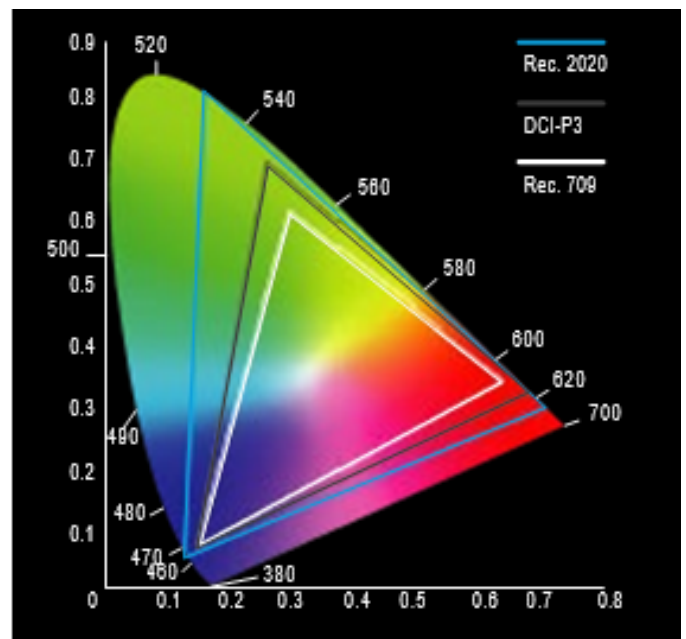
Reflection

When additional lighting is used in a film studio, every surface—including LED panels—can reflect that light, producing a mirror-like effect that is often undesirable. Darker LED panels yield higher image contrast and produce fewer reflections, improving the overall display quality.

LEDsynergy provides several options to minimize unwanted reflections. An anti-reflective treatment can be applied directly to the LED panel surface to prevent strong light sources from producing visible reflections. Alternatively, an anti-reflective mask can be fitted to the panel. Both approaches help the LED screen render more accurate colours and improved contrast, even in environments with substantial supplementary or daylight illumination. For guidance on the best solution for your setup, consult our sales and technical teams to explore available options and configurations.

Colour Shift and Viewing Angle

Colour shift occurs when the perceived colour of an LED screen changes as the viewing angle varies. This phenomenon results from the arrangement of the LED diodes (red, green, blue) within each LED package. Maintaining consistent colour reproduction across different viewing angles is crucial to preserve realism in virtual scenes and ensure a stable, reliable image for viewers positioned off-axis.



for viewers positioned off-axis.

LED Lighting for Film and XR Stages

High-brightness LED products, such as the LEDsynergy Carbon series CB5, serve effectively as ambient light sources on film and XR stages. When used as background or overhead illumination, these panels contribute natural reflections and subtle shadows that enhance the on-camera image, producing a convincing and pleasing visual effect.

Panel Brightness and Practical Use

In any studio environment, dedicated lighting is still required to properly illuminate actors and scene elements. Even when LED screens display bright virtual backgrounds, additional directional fixtures remain necessary to shape highlights, define contours, and match lighting direction for realism. Think of placing an LED panel in an outdoor-style setup: although the LED can be very bright, you still need local lights to reveal detail in foreground subjects.

One advantage of LED screens with virtual backgrounds is that directors of photography (DPs) can use light reflected from the LED imagery to help build a natural-looking set. A ceiling of Carbon CB5 panels, for example, can supply soft, consistent ambient illumination that complements key and fill lights.

LEDsynergy panels Core 1.25, 1.56.1, 83 offer wide brightness ranges, exceeding many competing products. This span—especially strong performance at very low brightness levels—is important because it enables precise matching to the scene's exposure without sacrificing image quality. Still, even with flexible panel luminance, practical film setups almost always require supplementary directional lighting to achieve the intended creative look.

HDR Considerations

High-dynamic-range (HDR) output is crucial in cinematic work: DPs aim to capture images that preserve bright highlights and rich shadow detail, producing a result that feels true to life. To realize HDR on screen, the entire signal chain must support HDR—LED panels, media processors, and the content itself. This end-to-end HDR workflow ensures the image retains extended contrast and colour fidelity from source to display.

Common HDR implementations use 10-bit colour, but LEDsynergy panels can support up to 12-bit output, allowing finer gradations and smoother tonal transitions. The Core range specifically support HDR playback using PQ and HLG formats. With optimized circuitry, these panels also accommodate high frame-rate playback up to 144 Hz, which can be beneficial for certain production requirements.

On-Camera Performance

The on-camera performance of an LED panel is a critical determinant of the final visual result. When LED panels and cameras are not properly synchronized, a variety of on-camera artifacts can appear, including ghosting, jitter, flicker, or image distortion. These disturbances compromise visual quality and can undermine production objectives.



Virtual Advancements

If you have a requirement for an y type of LED screen, particularly an XR Screen, then please give us a call and we would be very happy to talk to you.

To achieve consistent, high-quality imagery, precise synchronization between the camera and the LED panel is required. Fine-tuning this relationship involves adjusting refresh rates, shutter speeds, frame rates, and communication timing so that the panel's refresh cycle aligns with the camera's capture intervals. Because equipment models and configurations vary, it is not sufficient to rely on general guidelines: each unique combination of LED panel and camera typically requires dedicated testing and calibration.

Comprehensive testing should be performed by a qualified technical team using controlled test patterns and real-world content. Tests should document the settings that produce optimal results, including camera exposure, scan/rolling shutter settings, LED driver refresh characteristics, and any available frame-synchronization options (such as genlock or timecode). Teams should also evaluate performance across different operating conditions—varying brightness levels, contrast settings, and motion content—to ensure the solution is robust in production scenarios.

Documenting the results of these tests is essential. Maintain a calibration log that records hardware models, firmware versions, and the exact parameter values that achieved acceptable on-camera performance. This enables faster set-up for future shoots and helps troubleshoot issues that arise when components are replaced or updated.

In summary, achieving reliable on-camera performance from LED panels demands methodical synchronization and rigorous testing by specialists. Because each panel/camera pairing can behave differently, plan to repeat the calibration process for each new combination of equipment to ensure visual artifacts are minimized and production quality is maintained.

Bit Depth

Bit depth determines how many shades can be reproduced for each colour channel. Common examples: 8-bit yields 256 shades, 10-bit yields 1,024 shades, 12-bit yields 4,096 shades, and higher bit depths increase this range further. Insufficient bit depth can cause colour banding, where smooth gradients or large uniform areas (for example, a blue sky) display visible stepped bands rather than continuous tone.

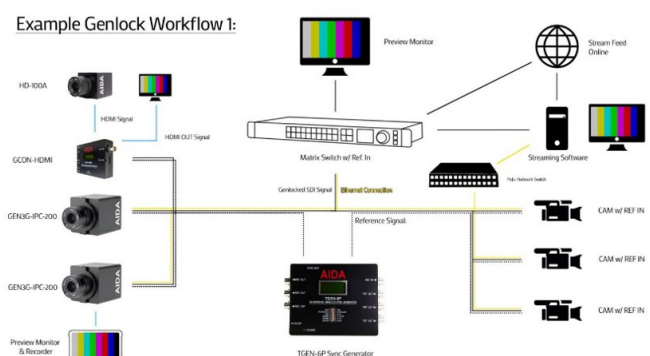
Typical practical bit depths for displays range from 8 to 12 bits. For on-camera virtual production work, additional bit depth at the driver level may be necessary to preserve image fidelity during capture and post-processing. LEDsynergy LED displays support up to 16-bit processing, enabling very smooth and accurate colour reproduction.

Genlock

Genlock is a synchronization signal used to align the timing of processors and peripheral devices. When multiple processors drive different screens, genlock ensures all screens refresh in sync to prevent image tearing. For cameras, genlock allows capture to be synchronized with the displayed content, which is essential for virtual production where camera motion and displayed imagery must remain perfectly aligned.

Heat Dissipation

LED panels produce heat, and on a virtual production stage composed of many panels this heat can affect colour consistency and create uncomfortable or unsafe working conditions for performers and crew. Proper heating, ventilation, and air conditioning (HVAC) planning is advised to manage ambient temperature and ensure stable operation.



LEDsynergy supplies BTU ratings for each LED panel, enabling you to calculate expected heat load and design appropriate environmental control. Panels using common-cathode technology typically generate less heat and can be a useful option when minimizing thermal output is a priority.

On-Site Servicing

LEDsynergy LED panels are designed for rapid assembly and reliable performance. For maintenance, many panels offer both front and rear module access, and power supplies are modular for easy replacement. These features reduce on-site downtime and simplify service procedures.

Curving

The capability to produce both curved and flat displays is essential for delivering a more immersive viewing experience. LEDsynergy LED panels can be supplied and assembled in either flat or curved configurations, specified at order, allowing designers and integrators the flexibility to choose the form that best enhances the environment and viewer engagement.

When planning an LED installation, consider the scale carefully. For small to mid-size studios, suppliers can typically provide LED panels produced in consistent batches. However, for large projects—such as installations using 1,000–5,000 panels—achieving uniformity becomes significantly more difficult. Producing thousands of panels in a single batch introduces challenges in maintaining consistent colour, brightness, and performance across every panel. Variations between batches or manufacturing runs can lead to visible differences in output, so discuss batch consistency, quality control, and testing procedures with your LED provider early in the procurement process.

Key considerations for large LED canvases

- **Batch consistency:** Ensure panels are produced from the same component and LED batches where possible to minimize variation.
- **Quality assurance:** Request detailed QA procedures and sample testing to verify uniformity across panels.
- **Replacement planning:** Establish how spare panels or modules will match existing ones over time.
- **Calibration strategy:** Plan for on-site calibration and colour-matching during installation and for ongoing maintenance.
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Typical XR stage setup and workflow

Extended reality (XR) stages combine real-world cameras with LED screens and real-time rendered backgrounds. Even a simple XR setup involves multiple synchronized systems working together:

1. **Camera tracking:** The camera's position, rotation, and zoom are tracked, and the tracking data is sent to the media server.
2. **Real-time rendering:** The media server renders the virtual background or environment in real time using the tracking data and outputs that imagery to the LED screens.
3. **Camera capture:** The camera captures the LED screens showing the rendered content and sends its video output back into the media server.
4. **Set extension:** On the incoming camera feed, a server (for example, a disguise server) composites the portions of the virtual environment that extend beyond the physical LED screens. This "set extension" fills in areas that would exist outside the LED volume.
5. **Final compositing:** The server outputs a composited program feed that includes camera footage of the LEDs, the set extension, and any augmentations such as AR elements.

All components must operate in perfect synchronization; any latency or jitter can break the illusion. For that reason, genlocking is essential: cameras, tracking systems, media servers, and LED processors should share a common reference clock to maintain timing alignment and avoid frame slips or misregistration.

British built - affordable satisfaction guaranteed



What we do

As an **established leader in the UK** with over 45 years experience in the business of supplying programmable LED screens and LED displays, you can be sure that we'll give you the right advice and excellent service, these are the values that we hold dear.

We are a British company and we pride ourselves in our commitment to our customers, product performance and quality of service. In the past 45 years or more we have installed in the region of well over 20,000 LED screens and displays to a broad spectrum of clients.

As a British LED screen manufacturer we are able to offer a **complete bespoke service from concept to commissioning** offering you the most cost effective solution to your needs with the knowledge that your LED solution, including software, has been built here in the UK.

If you'd like to talk to us about how we can help you just call us. There's no obligation and **we don't charge for quotations**. We can work together to be sure that the LED display we offer you is absolutely the correct solution for your requirements.

For demonstrations and to view our extensive range of LED displays please contact us to arrange a visit to our showroom at our base in Andover, Hampshire. Just call us on **01264 303030**.

Testimonials

" I've dealt with a lot of LED companies and I wouldn't ever now consider moving from LEDsynergy "
Paul Holland - WAE Group

" I am over the moon!"
Quartermaster
- Army Land Forces HQ "

" Well done, system all up and running for D-day, and very positive comments from all the staff. "
Richard Aschough - Bank of England

" Fantastic! - Replacing a scoreboard originally installed by LEDsynergy in the late 90's! "
Gerry Mc Mahon - Clyde FC

" Brilliant, thanks for a wonderful service & product! "
Chris Priddy - Qinetiq

" The LED check-in signs are working very well and appears to be speeding up our processes, a very good investment so far "
Mark Mason - Center Parcs

Accreditations



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