LEDsynergy
electronic displays

LED Displays - Everything Explained

MADE IN BRITAIN®

More than 50 years in the making

THE DEVELOPMENT OF LED TECHNOLOGY

Take a look down any high street, around any sports stadia, or indeed visit any location that attracts large groups of people and you're almost guaranteed to find an array of information solutions that are now based on light emitting diode (LED) screen technology.

Becoming a common sight in our everyday lives, LED screens are proving invaluable for so many different reasons but to the uninitiated it can be difficult, if not impossible to differentiate between the various technologies and qualities of products available. And it is so easy to get it oh so wrong.

While an LED screen may look almost identical to the next, there can be significant technical differences, and that's why there's often a significant disparity in the cost of buying from one supplier in favour of another. But what do you get for your budget, where is it best spent and how do you ensure that you select the best one to suit your needs? Here we hope to answer many of your questions and queries and give you the facts to help you make an informed choice…

Not all LED signs are the same: Simple but true and it's not just the technology. Some manufacturers cut corners on the build and design, sometimes using inferior LEDs, power supplies or other components; not all elements are suitable for external use or require additional cooling when installed in confined spaces; Also some "features" which are purported to be included aren't always built-in to the system.

How all the components are put together into the overall package can have a big impact on the overall operation of a finished solution. If the circuitry is badly designed then this will have a significant impact on overall performance and durability. A great analogy here was the explosion of personal computer companies in the late 80s / early 90s. Components were sourced from a variety of manufacturers and put together into the final machine but performance could vary significantly between two seemingly identically specified models; and the reason – the quality and source of the components used. Today only a handful of well-respected brands remain.

Different Standards

NOT ALL LEDs ARE THE SAME STANDARD

At LEDsynergy we often refer to three different grades of display – Gold, Silver and Bronze – but using motoring analogies is another good way to illustrate this so you will see these reoccurring through this document as a way of explaining some of the points we are trying to explain and help you with.

GOLD STANDARD LEDs

In respect to LEDs, it is widely acknowledged that the very best LEDs available today typically come from Japanese or USA manufacturers. So if reliability and durability are critical factors for your application then it's imperative that only the best the controller chips, power supplies, LEDs and other components are sourced and used for the whole solution – but this has cost implications.

Reliability will be high and life expectancy should be in the region of something approaching 10/12 years.

SILVER STANDARD LEDs

If you're prepared to balance price and performance then a broader supply based can be used. This means that your solution can take into account some of the better components manufactured in the Far East and increasingly some from China. Here knowledge and experience in selecting these is vital, it is also important to remember that any solution is only as good as the weakest link. Life expectancy 7/10 years. This we believe is the best option when comparing cost and performance over time

BRONZE STANDARD LEDs

Finally there is the budget end of the spectrum, which never the less does have its place in today's market. Again China currently tends to be the source of the majority these components. Often on the surface the components look the same as the more expensive ones, and indeed often boast the same technical specification, but their poor quality, design or manufacturing often becomes apparent just as soon as they start to be used. Life expectancy can be as low as 2- 3 years but shortfalls in performance are often quick to emerge and prove a real frustration to users.

A lot of people use the manufacturer's figures, typically 50,000 - 100,000 hrs. It is important to recognise that these are calculated, based on the solution being used in certain operating conditions – something that all displays in the field don't adhere to.

DIODE MANUFACTURE AND ENCAPSULATION

The type of material, methods and equipment used during the encapsulation process is a major consideration, as higher quality substrate and material will result in less heat, higher efficiency, higher brightness and prolonged diode life with lower brightness reduction over time.

GOLD STANDARD - Gold is the highest performing, most efficient and least heat producing substrate available. It increases costs relatively substantially. It is not generally required for indoor displays as they require less brightness.

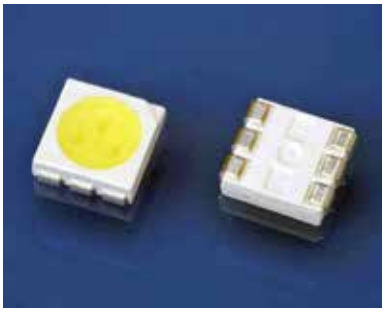
SILVER STANDARD - Copper is most commonly used because of it's cost effectiveness. It is better than tin and accepted as a reliable and good middle of the road solution.

BRONZE STANDARD - Tin is used but it is insufficient, resistive to current, thus produces more heat and means the diode must be driven harder, lowering its lifespan.

Components

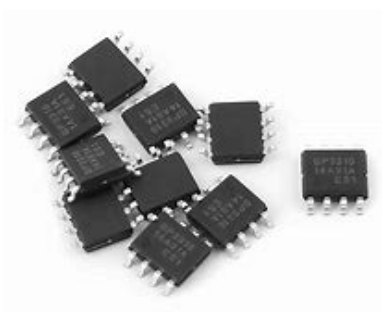
The key components that are included in the majority of LED systems comprise:

LEDs



Light Emitting Diodes (LEDs) are small lamps that emit light when supplied with electricity. They now come in many colours and shapes. Unlike incandescent lamps that convert electricity to heat and light with a filament, LEDs convert electricity directly into light so have no breakable filament, and are extremely efficient. There is a vast range in the of cost prices between poor and good LEDs. LEDs are the single biggest determining factor for both the quality of the display quality and its life expectancy. There is also a tremendous variance amongst LED suppliers in terms of both cost and quality. LED prices can range from less than one cent to 10 or more cents each. Not much when looking at the individual cost of a single LED but add together the number of LEDs that could be used in a single display system and the overall cost can become extremely large, rather quickly.

DRIVER CHIPS



Integrated circuits are used to control the brightness of each and every LED in a display this translates a digital signal into the exact colour needed for each pixel to produce a vibrant image. Again there is a variation in cost between a good integrated circuit design and build that doesn't run at full stretch, and a poor one that is at running at 100% continually.

POWER SUPPLIES

This is often considered the weakest part of a system but also the element that is most overlooked and neglected when designing an LED display solution. There can be a large variance in quality and performance. Some displays that are currently being sold in the UK are supplied with non-EMC compliant power supplies and this can cause customers problems further down the line.

LEDsynergy have recently designed and now manufacture power supplies specifically for LED displays, high end video LED etc.

Note: EMC is the interaction of electrical and electronic equipment with its electromagnetic environment, and with other equipment. To prevent the occurrence of EMC problems the UK government adopted stringent laws, first back in 1992, forcing all manufacturers and importers of electronic good to ensure that their products are electromagnetically compatible.

These are a few of the key components that go to make up a display that a customer may have a hand in specifying. Many others often don't get considered like the housings, electrical connections and even the wiring. Here again quality can vary considerably and performance and reliability can be significantly compromised if the wrong or inferior components are used.

DIRECT VIEW

New name for LED DISPLAYS to differentiate between LED TVs and monitors.

SYNERGY® Direct View LED displays are a cost-effective, all-in-one alternative to traditional video walls. Seamless, brighter screens backed with 40 years' experience and MADE IN BRITAIN

Components

MODULE CONSTRUCTION AND MOUNTING

LED displays are built using groups of LED's mounted to an LED Module, or panel. These panels will hold multiple LEDs, usually in grids or 8x8 or 16x16 pixels. These modules also house some of the hardware and circuits that control and drive the LED's on a fundamental level.

The construction of these modules is very important to the quality of the image. Just like mismatched LED's, modules that are not uniform in construction will create an inconsistent image across the display. This situation will cause a "patchwork" effect, where you can see the individual modules seams, making it look like a patchwork quilt. This may not be noticeable from directly in front of the display, but as you move to the side, you will quickly see the quality difference when lines start appearing out of nowhere.

BRIGHTNESS AND CONTRAST

These two principles go hand in hand on a quality display. The display has to be very bright during the day, but it also has to maintain contrast. The blacks must be black, and the whites, white. The contrast is physically determined by the louver face and LED panel design. As I mentioned before, flat black louvre panels affect this. The brightness aspect is determined by the LED's themselves, and how hard they are "driven". High quality LED's can be "driven" brighter without a significant loss of life. However, some sub par manufacturers will drive lower quality LED's harder, and they might be bright at install, but start to fail quite often, quite quickly.

Brightness for indoor can range from >1000 to 4000 nits and for outdoor from > 6000 to 10000 nits are typical ranges fro major applications.

COLOUR CALIBRATION

This relates to the Brightness and Contrast mentioned above, but also includes Colour. LED signs need to be calibrated to make sure red is actually red, or chartreuse is actually chartreuse. This is done by calibrating the video signal, and the internal hardware at the factory. Unfortunately there are still manufacturers out there, usually overseas direct, that do a poor job of calibration. The result is an end user with an LED sign that will always look worse than the others around it, regardless of any software adjustments they make.

DIODE COMPONENT SIZE

In addition to pixel pitch, diode size is another critical consideration. Surface mounted diodes (SMD) are the current industry standard for indoor and outdoor screens. The packed RGB diode components are mounted to the surface of the printed circuit board (PCB) as implied by the name. The alternative to this technology is dual in-line package (DIP).

SMD diodes contain filaments that produce the colours, red, green and blue, which constitutes one pixel. A matrix of pixels then forms the display surface area, which the target audience visually perceive as information in the form of pictures, scores, videos etc.

How To Select LED

Following are the key criteria for LED selection:

LOCATION - INDOOR, OUTDOOR OR SEMI-OUTDOOR

Location will determine some of the most important factors for selecting the correct LED. Whether the location supports access to the back of the LED display such as a rooftop, large billboards, stage backdrops or does it require front access for servicing the LED display, a different type of cabinet and module will be required. Additionally if the final location of the LED demands some transparency so that you can view through it, such as in a building display where the LED is on the face of the structure with its occupants needing natural lighting or viewing through the LED, in this instance then an LED curtain should be considered.

Where you intend to install the LED signage determines your selection.

Indoor - For inside the building and indoor environment spaces such as indoor arenas, lobbies of hotels, churches or shopping malls an indoor LED display should be used. The indoor LED must be protected from direct exposure to the harsh weather such as direct sunlight and rain. Controlled temperature will extend the life expectancy and up-time of the indoor LED display.

Outdoor - for locations outdoor and directly exposed to the environment such as stadiums, roadside, billboards, on buildings or free-standing outdoor, then an outdoor LED display should be chosen.

Semi-outdoor - If the location is protected from exposure to rain such as in a shop window then the semi-outdoor type should be used.

LED Curtain - If the natural light and viewing through the LED screen is required the curtain LED must be specified for indoor or outdoor use.

These factors make significant difference in cost per square metre to the final product being specified.

LED DISPLAY CABINET AND ENCLOSURE DESIGN CONSIDERATIONS

There is a large number of possible cabinet and enclosure options for each LED application. However, a knowledgeable user or designer will be able to specify the best solution that meets or exceeds all the application's needs. This specification should be justified by comparison of alternatives and selection of the one that best meets the user application needs.

Generally, the standard size for an outdoor cabinet is 960mm x 960mm and an indoor cabinet is 640mm x 480mm

The various cabinet and enclosure options are designed to best meet the application's requirements such as:

- Permanent or Temporary installation
- Message (Text) or Advertising (Full Colour Video)
- Asynchronous (no computer or server, could use a media player) or Synchronous (with server)
- Fixed or Variable with or without real-time
- Fixed or scrolling text

How To Select LED

FRONT SERVICEABLE CABINETS

If installed incorrectly, servicing your LED screen can be a major headache. Here we look at three different cabinet types that allow for front or rear servicing. Having a good understanding of where you want to install your LED screen will help you decide what sort of cabinet to choose. This decision will be dictated by space and accessibility.

Front serviceable LEDs come in three forms, as a stand alone hinged cabinet, key access or magnetic, however magnetic can also be rear serviceable.

Front serviceable cabinets are suitable for both indoor and outdoor applications. Since the front serviceable cabinets do not require access from the rear, they can be installed against a wall, or area that has no accessibility from the rear.

Stand alone hinged front serviceable cabinets cannot be installed on top of one another due to the hinge being on the top of the cabinets, if you stack them this would impede the opening of them.

There are no height restrictions when using key or magnetic modules. A screen configuration can be as tall or wide as you please. The only limitation of a key or magnetic screen is the module size, the total width must be a multiple of the module size. Front serviceable cabinets with key access are used on most external installations.

Hinged Stand Alone

Key Module Access

Magnetic Modules

REAR SERVICEABLE CABINETS

Whether it be a free-standing sign or on the side of a building; rear serviceable solutions are ideal for new structures where the LED screen is included in the design and planning phase. For large serviceable LED screens there needs to be a minimum space behind the cabinets of 600m. The primary purposes of this space is to allow non obstructed access for a service technician. This space also has other benefits such as air flow and must be well ventilated.

For small rear serviceable LED screens we recommend a minimum space of 50mm to allow airflow, however when designing you must bear in mind access for a technician, there are many ways to achieve this. As with front access screens, rear access LED screens are suitable for both indoor and outdoor applications.

Not all Manufacturers are the Same

LEDSYNERGY

Likewise not all LED sign manufacturers are the same: This is where it can get extremely complicated for anyone looking to buy an LED based solution. A number of sign manufacturers, particularly those that market a product range, typically look to bait-and-switch customers by offering seemingly cheap products which invariably include cheaper components or designs.

An LED display is really just a large group of individual LEDs laid out on a grid, like your computer monitor or TV. Individual LED's come in many colours, shapes, sizes, configurations and quality. These factors all come into play when dealing with the image on an outdoor digital sign. High quality LED's that are matched correctly will significantly improve the image displayed.

LED manufacturing is not perfect, and every LED manufacturer must deal with a certain variation of colour from LED to LED. The method used to organize LED's with the same colour is typically referred to as "binning". LED's with the same colour output within a certain tolerance will be put together. This is very important for both indoor and outdoor digital signage because they are using so many LED's that if you didn't bin correctly, the display would look "blotchy" from the different shades of Red, Green or Blue LED's spread out across the entire unit.

It's important that the manufacturer address this and can reliably replace LED panels with LED's in the same "bin grade" as the rest of the sign. You can see this pretty clearly on a display that has one or two squares that are "tinted" against the rest of the sign. Unfortunately this usually means that the manufacture wasn't able to provide a matching LED Module (or panel) and the business had to settle for the best of two evils, have a blank square, or a "tinted" square.

Heritage also matters and it's not uncommon for manufacturers to claim that they are the biggest and best within the market, when in truth they are simply assembling components sourced from around the globe in a small production facility. Just as was the case for PC manufacturers! – At LEDsynergy, we have been manufacturing and supplying LED displays for 40 years, we know what we're doing, we know what our customers need and we deliver on our promise.

Even a seemingly impressive customer list may not truly reflect the quality and ability of those developing and delivering the solutions. It is vital that LED manufacturers have a true understanding of all aspects of delivering an LED based solution including hardware, controllers, software development and even installation as it is only when problems arise does a knowledgeable and experienced supplier truly stand out from the pack. And it's at this precise time that they can make the difference between delivering the solution you envisaged and simply supplying something that might be acceptable- or not!

It is often difficult to even produce a decent specification, especially as some component manufacturers produce slightly mislead or subjective specifications. Using our car analogy what vehicle do you think we are we describing here?

"It must have four doors: a boot: four 4 forward gears: and one reverse gear: Interval wiper: Alloy wheels: Sliding / tilt sunroof: Metallic paint, Keyed bumpers, Tinted windows: Rear privacy glass: Electric mirrors: Folding door mirrors with integral turning signals: Automatic dimming mirrors: automatically turn on lights: Xenon headlights: Fog lamps: Daytime running light Headlight washers: Anti-theft alarm: ABS: Electronic Brake Distribution: Brake assistant: Driver air-bag: Passenger air-bag: Side air-bags: Electronic Stability Program : Traction control: Locking differential: "

This could be a top-end Rolls Royce, or a Lada or most vehicles in between?

What do You Need to Know?

KEY QUESTIONS TO ASK TO ENSURE AN LED SCREEN MEETS YOUR NEEDS?

You've already done your research into suppliers and asked about the quality of components used so you're more informed than some but what questions should you be asking your selected supplier to hopefully help steer you away from many of the pitfalls that could await you. Well here are some key questions:

How big a screen do you think you need?

When you are considering buying an LED display there are many options to consider. Not only the type of display that you require and the budget that you allocated but also the size of the display and the pitch and resolution of the LED sign. This will be primarily governed by the area available and also the distance the audience will be from the display.

An LED screen is made up of pixels and the higher the density of the pixels the higher resolution the image will be. The pitch is the distance between each LED and the smaller the pitch the higher the resolution, but we will explain this in depth in the next few pages.

Once you have weighed up all your variables from viewing distance, area available, budget and application, such as full colour video or text information, then we can work out what's the best size for you.

How do I operate my LED Display?

You will find them very user friendly and simple to use, at LEDsynergy operator training is of course available for all systems and most of our displays are supplied with an instruction manual.

You can operate LED displays with a computer, simply connected by cable to the display. Or you can run them across local or wide area networks using Ethernet, Bluetooth, Wireless, Modem or SMS. We can help you choose the operating methods that suit you best.

We have standard software packages that will operate the displays for the majority of applications but we can also write software that will run the display automatically, all you have to do is switch it on and the software does the rest. If your requirement is more complex we can write bespoke software for your application, we can liaise with your IT department if you have particular requirements.

How much will an LED Display cost?

The majority of LED displays are built to the customers requirements and individual needs, the cost is dependant on many factors such as the size, LED pitch, resolution, whether it is for indoors or outdoors and are there any specialist support frames or casing required. Each job is different and the price will vary accordingly.

Are the Products compliant with UK and European Standards?

This is a question that is extremely important, there are a lot of bad quality LED products on the market that just don't comply with quality standards and, of course, these products will not only fail quickly but may also be a safety hazard.

When you buy from LEDsynergy you have the peace of mind that comes with knowing that our products meet the highest standards. All our products comply with a number of different process, product and safety standards including:

CE - European conformity mark. This means that products comply with all relevant EU directives in our field.

ISO9001 - This proves that the processes are in place to produce products to the appropriate standards of quality.

EMC standards - EN61000, EN60950 IEC 950 – these standards control the quality and safety of LED products.

UKCA - A new UK product marking for goods which previously required the CE marking.

Size of Your LED Display

WHAT SIZE SCREEN DO YOU NEED?

When deciding on an LED screen it's not the size that you should consider first, it's the viewing distance and your budget, buy the highest resolution that you can afford. As an example both of these screens shown below are 1.5 by 1 metre but one is 10mm pitch (lower resolution) and one is 3mm pitch (higher resolution). Depending on how far they will be viewed determines whether they will be suitable or not.

The 10mm pitch screen shown on the right would be suitable if the viewers were approx. 10 metres or more away, any closer and you will see pixilation. As you can see the image is not as crisp as the higher resolution board, but at 10 metres it will look fine, the image below is shown being viewed at the same distance as the 3mm screen which of course wouldn't happen in reality. The smaller image is how it would appear at the correct viewing distance, 10 metres. The screen shown on the left is a 3mm pitch and therefore, can be viewed from 3 metres away as it has a much higher resolution but of course costs considerably more than a 10mm pitch screen.

Once you know your viewing distance you can then decide on the best LED pitch size and therefore, resolution within the constraints of your budget.

- **Longer Viewing Distance, Larger Pitch gives you a Lower Resolution = Lower Cost**
- **Shorter Viewing Distance, Smaller Pitch gives you a Higher Resolution = Higher Cost**

2mm pitch
500 x 333 resolution
1000 x 667mm
Viewed at 2 metres

6.67mm pitch
150 x 100 resolution
100 x 667mm
Viewed at 2 metres which is too close!

Shown right at 6 metres the correct viewing distance

Consider Your LED Display Use

WHAT MATERIAL WILL YOU BE DISPLAYING?

Full Video Content - Video with Scoreboard - Static Pictures - Text Only

You will need to have a clear idea of the uses and location and we can then help you find the best solution

CONSIDER YOUR FUTURE NEEDS

While you have calculated the optimum LED sign for your current needs, before committing to a solution you should also look at how your requirements may change over the next 12-18 months and seek to factor this into your current requirement ideally you don't want to be constricted by what you can do just a few months down the road. And is there an effective upgrade path for the hardware so that this can be "future-proofed" as it's a guarantee that it's going to become old technology faster than you can install it.

AND MOST IMPORTANTLY - KNOW EXACTLY WHAT YOU'RE GETTING

You should know what components are included with the solution being provided and also what elements you're expected to supply. Once the LED screen is supplied will it come with simple ARM-based Embedded Control Card system running off of a 1-2 gigabyte flash card or a top-of-the-range industrial PC, running top specification processors with massive storage capacity. More importantly would you be required to provide either of these? And is the solution simply being delivered or will it be fully installed with your programme uploaded and running smoothly before they leave you and with a support package in place.

Don't be bamboozled by 'tech talk', get clear precise answers before you make any commitments. Investing time and effort now can often avoid heartache, pain and significant additional expenditure further down the road. And hopefully this document will help you be more aware of your requirement and be better able to spot the difference between a good partner and a bad vendor.

LED Pitch Explained

LED PITCH

LED pitch and resolution are industry terms that you will come across when you are researching LED display technology and we thought that we would explain it to you as it's not the simplest thing to understand!

An LED screen is made up of pixels – primarily each is typically made up of one red, one green and one blue LEDs (DIP) individual LEDs. Alternately and more common for internal displays a small single encapsulated unit incorporating the three LEDs – is used which are surface mounted (SMD) The LEDs in each pixel light up to different intensities to create a specific colour, updating many times a second, and each screen is made up of hundreds or thousands of pixels, creating a seamless picture.

PIXELS AND PITCH

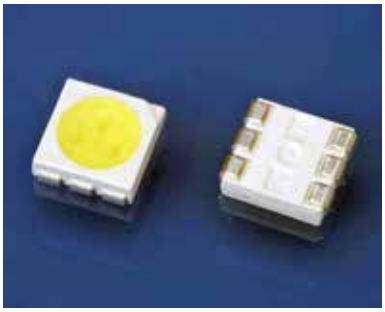
Pixel pitch, what does this mean in terms of practical application as it is used in digital display technology.

First, let's define what a pixel is before we discuss its "pitch." In digital imaging, a pixel, is a physical point in an image, or the smallest addressable display element in a display device; so therefore, it is the smallest controllable element of a picture represented on the screen.

DIP PITCH

Each pixel is a sample of an original image; more samples typically provide more accurate representations of the original. The intensity of each pixel is variable. In colour image systems, a colour is typically represented by three component intensities such as red, green, and blue.

SMD



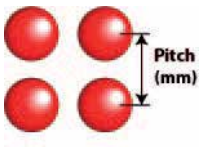
On a discrete LED or (Surface Mount Device – SMD) LED display, a pixel is in actuality an LED lamp composed of three "sub-pixels," each of which is an individual LED comprising the three RGB components.

Now let's discuss the "pitch" or "pixel pitch." In its true definition, "pixel pitch" is the term used to describe the distance between similarly coloured pixels. The term "pixel pitch" is typically reserved for LED display panel technology.

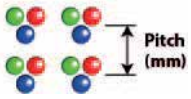
In relationship to outdoor/indoor discrete and SMD-LED display technology we are talking about the horizontal and vertical distance between the centres of discrete LED lamps composed each of a red, blue and green diode.

PIXELS PITCH

Pixel pitch is the distance from the centre of an LED pixel or cluster to the centre of the next pixel / cluster measured in millimetres. When it comes to buying your LED display finding the right pixel pitch that's right for your application is vital to the success of your display.



Pixel pitch typically ranges from 1.5mm to 10mm for indoor LED displays and 6mm to 20mm for outdoor displays although further options are indeed available, even up to 100m pitch for specific outdoor applications.



The pixel pitch is a defining factor of a large screen's viewing distance: the closer the pixels are the closer the minimum viewing distance will be and also the higher quality of the image displayed and the cost per sq. metre. A larger pitch will cost you less but you risk losing the clarity of the image.

LED Pitch Explained

WHY IS PIXELS PITCH IMPORTANT?

Pixel pitch directly correlates your display resolution and optimal viewing distance. The smaller the pixel pitch the more pixels are used to make up the image of your display. This will improve the resolution of your display and optimal viewing distance. In basic terms this means that the lower the pitch, the closer you can stand to the display and still have good resolution.

Obviously, you get a much better quality image from a lower pitch display, but of course this comes at a cost! By having a smaller pitch you increase the number of LED pixels or clusters in your screen and the more you have the greater the cost. So it becomes a bit of a balancing act between budget, pitch and screen size whilst considering where the display will be installed and the typical distance that people will be viewing it. The key is to buy the highest resolution that you can afford.

Shown right is a 1 x 0.5 metre display at four different LED pitch, hence different resolutions and quality of image. The higher the pitch value the further the viewing distance in metres.

When deciding which pixel pitch is right for your application, it is dependent on a combination of factors, which include the viewing distance or range of distances of your primary audience, the content you intend to put on the display (i.e. text only, animation or video, etc), the size of your sign and of course your budget. Each application is different so please contact us so that we can make sure that you are looking at the right screen.

So what does all this mean for my potential LED display application? At the end of the day, when inquiring about the pixel pitch of a particular LED display grid, you're in effect asking – "How clear is the imagery I'm trying to show going to be?"

The image left shows approximately how your eyes will perceive the image at the correct viewing distance for the pitch.

10mm at 10 metres plus

6.67mm at 6 metres plus

4mm at 4 metres plus

2mm at 2metres plus

Each panel below shows a screen 960mm x 480mm viewed at 2 metres which will visually only work for the 2mm pitch

At the correct viewing distance for the pitch the image will look crisp to the naked eye as shown below left.

10mm pitch - 96 x 48 pixels viewing at 2 metres

6.67mm pitch - 144 x 72 pixels viewing at 2 metres

4mm pitch - 240 x 120 pixels viewing at 2 metres

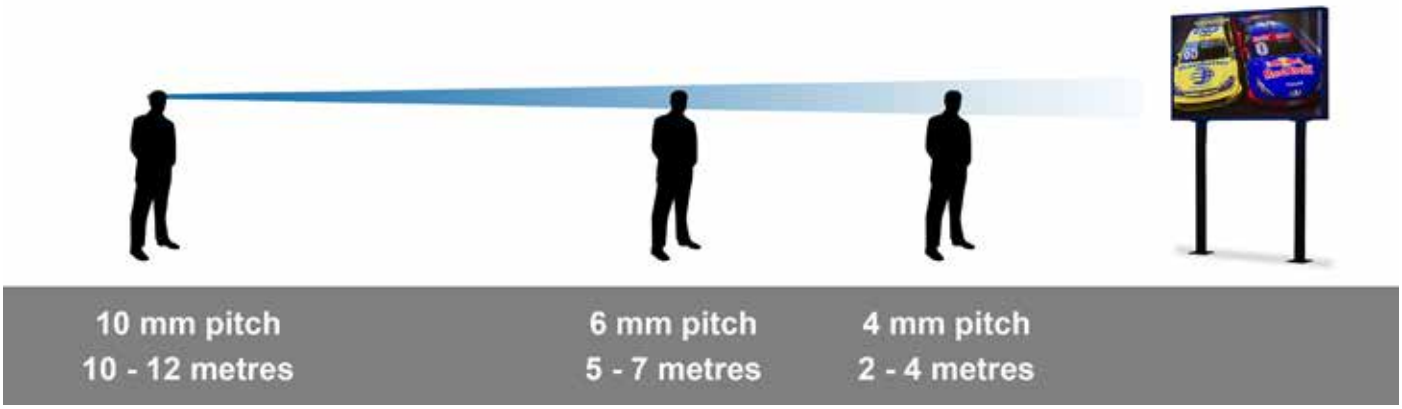
2mm pitch - 480 x 240 pixels viewing at 2 metres

LED Pitch and Viewing Distances

VIEWING DISTANCES FOR VARIOUS LED PITCH

One of the primary factors in deciding on what pitch size will be right for you is considering what the viewing distance will be of your primary audience. The viewing distances are somewhat subjective and depend on the distance type, content and the physical size of the screen. But essentially a good rule of thumb is to say that the minimum distance is measured by taking the pitch and converting it into metres, i.e. a 10mm pitch has a minimum viewing distance of 10 metres. If you stand too close to a display you will see pixelation and the image will not be clear. That is to say, there is a minimum distance beyond which a human eye with natural or corrected vision of 20/20 can no longer discern individual pixels on a particular display. The maximum distance depends on the screen's dimension but it can roughly be calculated by multiplying the screen's height by 30. For example a 4 x 3 metres screen (3 m x 30) can be viewed from 90 metres.

When it comes to reading text on a display the basic rule is that 1 cm of text can be read from a distance of 5 metres, therefore 10 cm high text can be read from approximately 50 metres.



GET THE CORRECT PITCH FOR YOUR VIEWING DISTANCE

The illustration right shows you the same size of display with different resolutions and pitch but shown at the correct viewing distance so the image appears to the eye to be the same. Obviously, the 10mm pitch screen costs much less than the 3mm screen but will only be suitable for viewing distances over 10 metres, whereas the 3mm pitch can be viewed at 3 metres and above.

3mm pitch can be viewed from 3 metres

6.67mm pitch can be viewed from 6 metres

10mm pitch can be viewed from 10 metres

Image above is a 10mm pitch screen, 150 x 100 resolution viewed at 10 metres

Image right is a 3mm pitch screen, 500 x 333 resolution viewed at 3 metres

Viewing Distance

HOW FAR AWAY WILL I BE ABLE TO SEE IT

So what does all this mean for my potential LED display application? At the end of the day, when inquiring about the pixel pitch of a particular LED display grid, you're in effect asking – "How clear is the imagery I'm trying to show going to be?"

That question is going to be answered by several additional ones including a:

At what distance would MOST of your audience be likely to view the completed display installation?

MINIMUM VIEWING DISTANCE

Depending on the pixel pitch of the display, there is a minimum viewing distance before an image "pixilates." That is to say, there is a minimum distance beyond which a human eye with natural or corrected vision of 20/20 can no longer discern individual pixels on a particular display.

A general layman's rule of thumb it that distance is roughly 1x the distance in metres as the pixel pitch is in millimetres. For example if a display was manufactured using a 5mm pixel pitch, you would begin to recognize individual pixels on the display at about 5m and closer (1m.x5 =5m.).

Obviously it is possible to be nearer than this and identify the pixels without detracting from the image/text.

MAXIMUM VIEWING DISTANCE

This is generally 20-30 times the LED screen height.

For example a 4.8 metres high screen: 30 x 4.57 m = 137 metres maximum viewing distance.

THE SMALLEST VIEWING DISTANCE AND LED DISPLAY SPECIFICATION

With LED display technology, however, this minimum viewing distance can be conditionally based on the overall surface area covered by the display. This is true for a number of reasons. One, if a display is 7m width by 5m high it will have exponentially more pixels to replicate the intended image than say a display of 3m by 2m providing more information for your eye to process, thereby increasing human-eye perception of resolution.

Additionally, because LED is a light-emitting technology versus a light-reflecting technology, the gaps between pixels tend to "soften" and are therefore, perceived as less distinct when resolved by the human eye. This optical artifice is accomplished in much the same way that oncoming automobile headlights at night radiate light into the surrounding dark space immediately surrounding their edges.

Now while the electronics that make up an LED display system is not something that interests everybody:

You can always buy and drive a high performance car and never know what exactly is under the bonnet, but you still enjoy the thrill of the drive and appreciate the technology that has gone into developing and building it. Similarly with LED displays, you can appreciate a good LED display system without understanding the technology. But this is where style and content becomes more important.

Screen Resolution

LED SCREEN RESOLUTION

Your LED display screen will be made using thousands of LED pixels or clusters. The image can be seen on the screen by the software changing the colours of the thousands of LEDs to form pictures, text and videos.

Screen resolution is the number of LED pixels contained in the physical area of the LED display. The more pixels you have per square metre, the more detail you will have which gives you a higher resolution.

For a set screen size, the closer the LEDs are, (i.e. smaller LED pitch) the more LEDs you have in that area, hence the higher the screen resolution. This means, of course, the overall quality of the image will be better and your viewing distance will be reduced, but this comes at a cost as the price per square metre goes up.

The screen resolution tells you how many LED pixels / clusters there are horizontally and vertically thus allowing you to calculate the overall LEDs. It is usually written in the form 512 x 256 resolution. This means that there are 512 pixels wide and 256 pixels high.

Each square metre of an LED screen usually contains anywhere between 62,500 pixels (250×500 pixels) down to 9,216 pixels (96×96 pixels) depending on the models – there are many varieties. The pixel pitch is a defining factor of a giant screen's viewing distance: the closer the pixels are the closer the minimum viewing distance and also the higher quality of the image displayed and the cost per sq. metre.

RESOLUTION - WHY DOES IT MATTER?

The key to a quality image on a large-format video LED screen is to buy the highest resolution you can afford. An LED screen's resolution is defined by its total number of vertical and horizontal pixels (dots that form the picture). The video signal that the LED screen will be reproducing has a native resolution of about 486/576 (NTSC/PAL) vertically and anywhere from about 240 to 720 horizontally (depending on the quality of the source). To reproduce these signals with no loss of image resolution, you want a minimum LED screen resolution of about 648 x 486 (NTSC) or 768 x 576 (PAL). If you use an LED screen with fewer pixels than the input source, the images will have less resolution than the source. However if the LED screen is designed properly it can still give an acceptable appearance for video images. LED screens of approx. 1/3 of VGA resolution can provide a very acceptable video image, so around 200x150 pixels are OK.

Now, different size screens can still have the same resolution, but the different pitch size means that the screens will be different sizes. You can see in the example below, the resolution on all four screens is 128 x 96 and the pitch varies from 3mm to 10mm. The means that you will get the same picture on each of the screens but the overall screen size is different.

Screen Content

GETTING THE BEST OUT OF YOUR RESOLUTION

Adopt good design practice: If you have a good designer that understands LED design rules, your piece should stand out among your competition. An LED screen is usually a significant financial investment and so often the final implementation is let down by poor or overly complicated design treatments. Ensure that you budget for ongoing content development and a good designer is an absolute worthwhile expenditure. And don't forget to check and test your content.

Review existing content on the LED display every week to ensure it's working properly and nothing looks dated. Also seeing the content as your spectators do provides an essential perspective and should help create future content and the right experience for them.

CONTENT IS KING

There must always be fresh, updated, curious or useful content on your LED display - not just advertisements - otherwise people will get accustomed to them and become bored with the LED screen and stop looking at it. You must constantly provide updated content – so if it's an information system, the content has to be up-to-the-minute; if in high daily footfall areas new, useful and interesting content should be uploaded every day or at least every time you expect the same audience will revisit the same location.

CONTENT BALANCE

Creative content may grab the spectator's attention but making a piece that is stunning or memorable without a clear call to action could fall short of your intent. This happens when people concentrate too much on creative content and forget the purpose of the content. Remember what you want anybody looking at your LED screen to do is act on whatever they've seen.

These LED screens show how good content can be informative and attractive. Images catch they eye then you can entice your audience to read the information.

As you dive into content creation for your LED you will no doubt develop your own rules but these 'best practice' guidelines should get you started.

Remember, LED displays are incredible tools for communicating your message but they are only as good as the content you run on them.

DIRECT VIEW

New name for LED DISPLAYS to differentiate between LED TVs and monitors.

SYNERGY® Direct View LED displays are a cost-effective, all-in-one alternative to traditional video walls. Seamless, brighter screens backed with 40 years' experience and MADE IN BRITAIN

Screen Content

CONTENT CREATION

And it's not just about the hardware. Content creation is vital – so here we look at Best Practices: Content creation needs to be done in parallel with hardware specification to ensure that when your new LED sign is installed you have appropriate and impactful material to display on it that will meet your marketing objectives. If you're contemplating an LED display for the first time, you are probably wondering where to start and it's likely that you will need a little help. So the following suggestions will hopefully point you in the right direction.

RUNNING TIME

Understand your audience and make sure that your copy length is well suited for the viewing time available. In large venues, suited to digital out-of-home advertising, 10 to 25 seconds is typically recommended. Anything longer and you run the risk of the spectator missing the beginning or moving on before the end - You want them to see the entire piece – particularly as the call to action is usually at the end. Obviously on the entrance to say a pub, short sharp message to attract attention, as the audience will look at for only a short period. In the pub, longer as the audience will be more static

SIZING THE TEXT

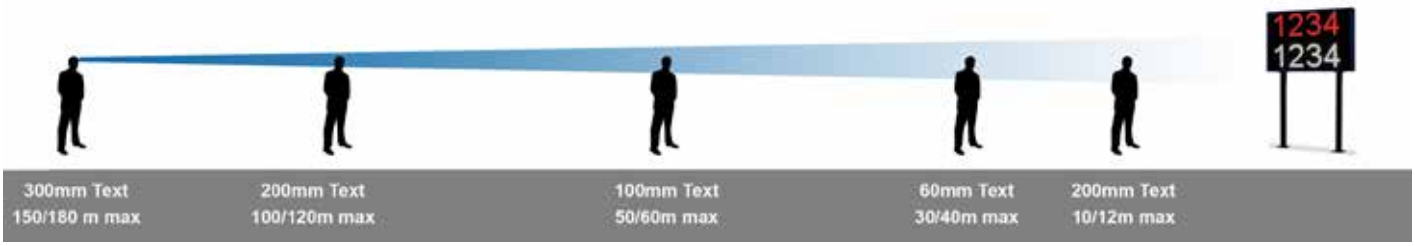
When placing text on large LED matrix screens which also include graphics, the size rule still applies but the appearance of the text is also important. Small text might look nice when created and displayed on a PC monitor but it's not good when put up onto a large LED screen.

Other text rules: Avoid shades or glossy effects on text as while these effects may look nice on your high definition monitor they just don't show up on an LED display as it has far fewer pixels. Sans-Serif fonts like Ariel, Helvetica or Tahoma are much more ledge-able than Serif fonts like Times New Roman. And remember that the basic principles of the colour wheel still hold true for digital signage. Contrasting colours like black, green or blue on yellow or white, or vice versa, work really well.

TEXT DISPLAY

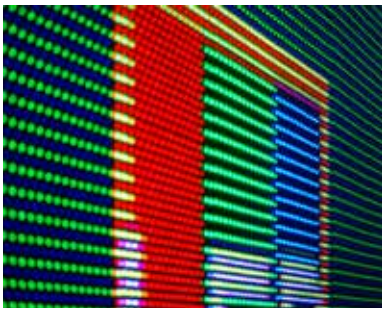
If it's just simple text in a single colour then you may only require a matrix that is just 8 pixels high by whatever length the message happens to be or the rolling length, but if you're viewing the text from distance you will need to increase its height.

The rule of thumb is for each 25mm Text height = 12m viewing



What Else Do I Need to Know?

DEPTH OF COLOUR



The number of colours available also affects the image quality. Displays that use 8-bit technology can display 256 colour levels for each of the three primary colours. This means that they are able to visualize 256×256×256 or 16.8 million colours in total. More recently displays using 16-bit technology for each colour that are able to visualise 65,000 colour levels for each of the three primary colours - visualising 65,000×65,000×65,000 or 275 billion colours in total. There is no big difference to the human eye between a display with 16 million colours and one with 275 billion-colours, particularly if the screen works at the highest luminosity. The differences begin to be visible when it works at reduced brightness, often implemented to slow down the natural decay of the LEDs and to reduce power consumption. Having a palette of 65,000 colour levels allows an incredibly superior quality and naturalness, even at the lowest brightness levels.

"It has been estimated that humans can distinguish roughly 10 million different colours, although the identification of a specific colour is highly subjective, since even the two eyes of a single individual perceive colours slightly different." - Wikipedia. 2006.

LOCATION, LOCATION, LOCATION

Having the biggest and best quality LED screen, if it's in the wrong location, means you simply will not reach your audience or get an appropriate return on your investment. Likewise if it's a low-grade screen in a prime location you're squandering opportunity. There is also quite a bit of legislation that restricts the sighting of LED screens in certain locations, particularly if they are likely to pose any form of danger to the intended or passing audience or may even be seen as a nuisance. Ask the question and do your research before embarking on a development programme.

REFRESH

LED video screen manufacturers frequently use refresh rate as a marketing tool when boasting excellent screen quality. The presupposition is that the higher the refresh rate the better is image quality. However, often the numbers serve only to confuse potential customers. For instance, refresh rate of several kHz means that either the modified PWM generation method is used (when refresh rate is in fact different for different brightness levels) or that the colour depth is unacceptably low.

We should remember that high refresh rate and high colour depth values may only occur at high brightness levels which in itself are a misconception, since a LED video screen should not always operate at 100% capacity. For the case of interlaced scanning the refresh rate value will only correspond to one PWM cycle for one LED group, while the actual refresh rate for the screen (which affects our perception) will be several times lower.

It is more informative and honest to mention colour depth and clock rate for PWM and approximate range of refresh rate for the screen (for example, 200 -1000 Hz) in case of modified PWM screen function. If a LED video screen is based on the time division principle (for example, time division = 1:1 – absence of time division, time division = 1:2 – PWM only operates on half of the screen etc.).

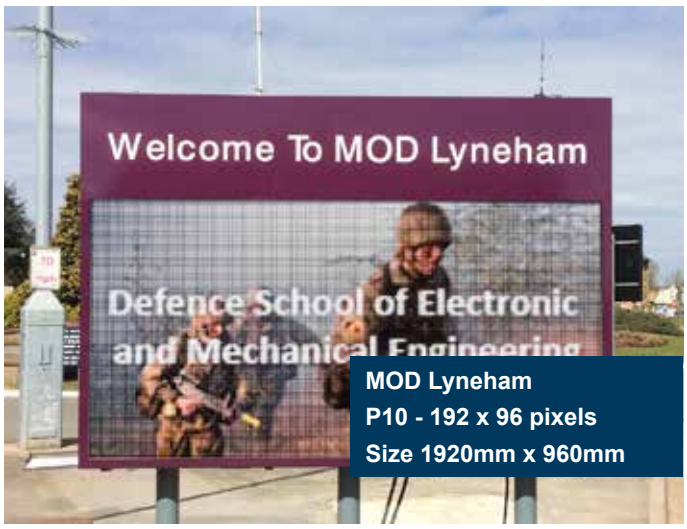
The above parameter is not essential for our perception. The human eye does not register any difference in image quality at frequencies above 100 Hz. Consequently, one should decide if a high refresh rate is really necessary and if it is worth while paying extra for it.

Refresh rate and uniformity of recorded screen image are only important in cases where a LED screen frequently becomes an object for video recording (stadiums and concert halls). Therefore, it is better to first conduct some trial recording prior to signing the purchase contract.

Call us or email us at LEDsynergy and we can help you to establish what type of LED solution is right for you and guide you through the process of your LED experience.

Examples of Pitch, Resolution & Size

Marlowes Shopping
P8 - 400 x 240 pixels
Size 3200mm x 1920mm



MOD Lyneham
P10 - 192 x 96 pixels
Size 1920mm x 960mm

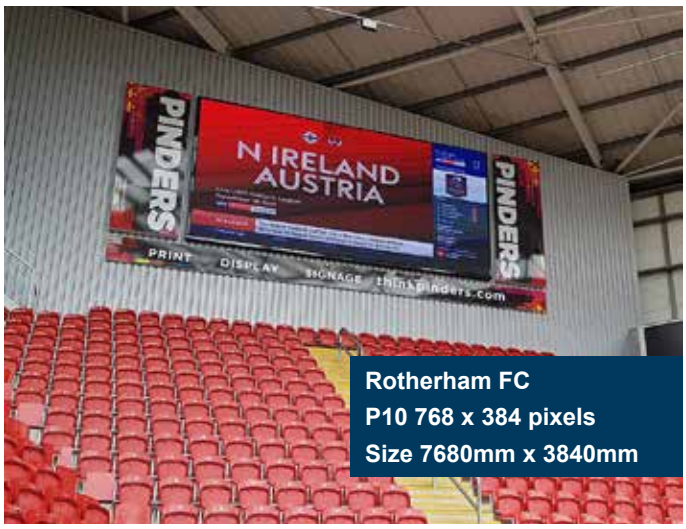
TM Lewin Canary Wharf
P3 - 768 x 832 pixels
Size 2300mm x 2500mm

North Kent College
P6.67 - 576 x 384 pixels
Size 3800mm x 2560mm

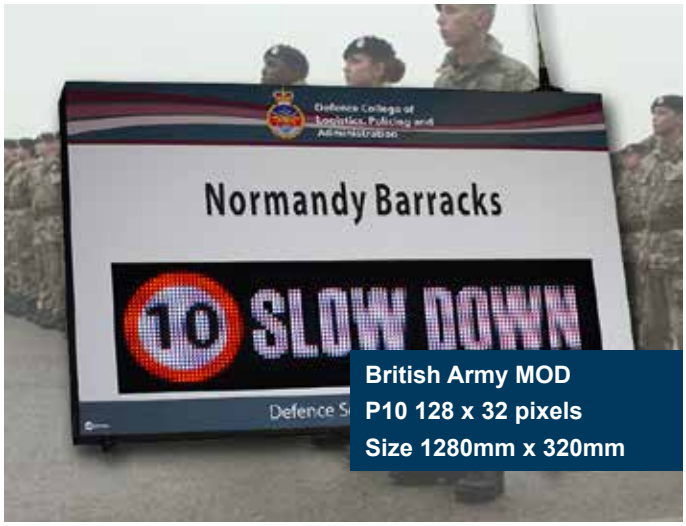
West Cross
P6.67 - 224 x 416 pixels
Size 1500mm x 2770mm

Examples of Pitch, Resolution & Size

SSE Hydro Glasgow
P10 160 x 144 pixels
Size 1600mm x 1440mm



Rotherham FC
P10 768 x 384 pixels
Size 7680mm x 3840mm



British Army MOD
P10 128 x 32 pixels
Size 1280mm x 320mm

Wife To Be
P8 640 x 360 pixels
Size 5120mm x 2880mm

Kuwait University
P3 1792 x 1024 pixels
Size 5400mm x 3100mm

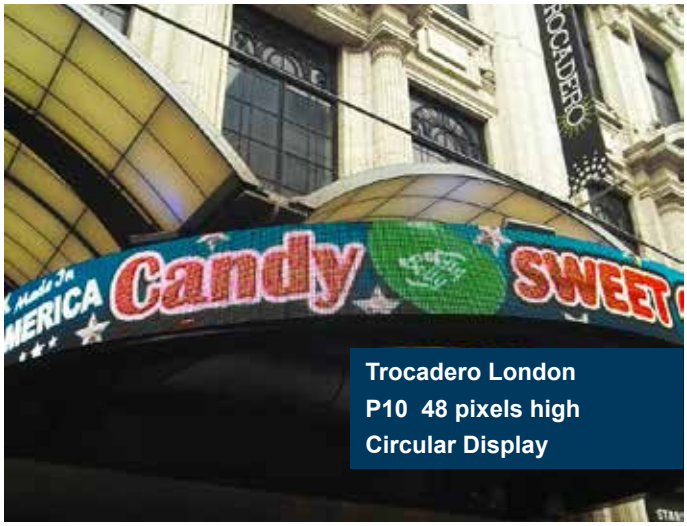
Examples of Pitch, Resolution & Size

Bedfont Sports
P10 384 x 96 pixels
Size 3840mm x 960mm

O2 Arena London
P10 160 x 144 pixels &
P6 144 x 72 pixels

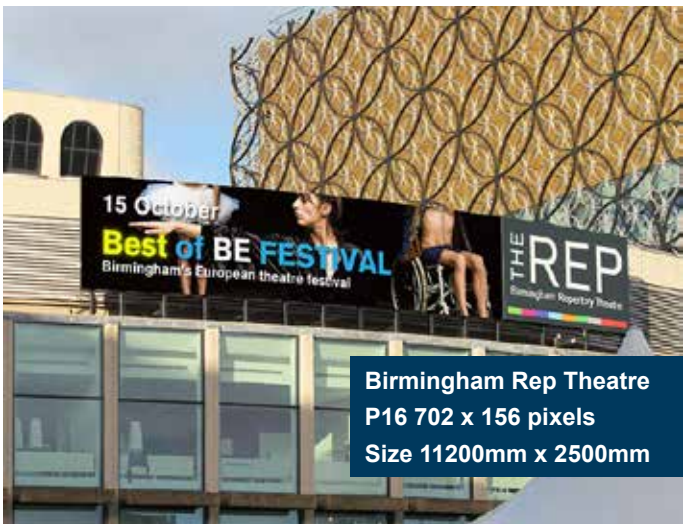
Topshop
P6 224 x 704 pixels
Size 1350mm x 4200mm

Otium
P6.67 864 x 480 pixels
Size 5800mm x 3200mm



Trocadero London
P10 48 pixels high
Circular Display

Examples of Pitch, Resolution & Size

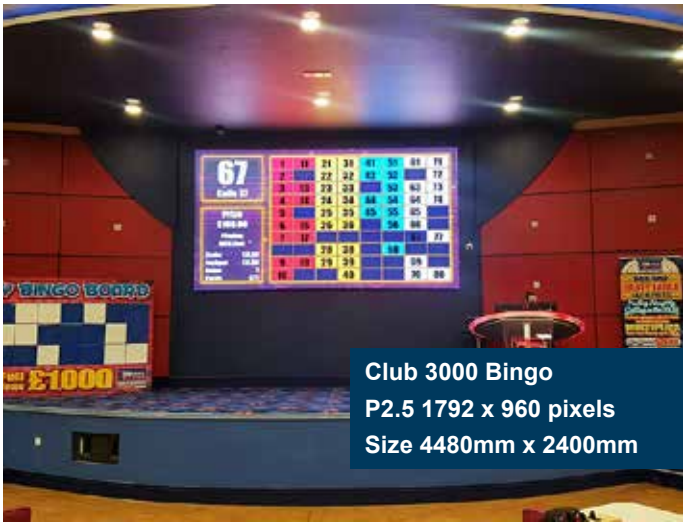


Birmingham Rep Theatre
P16 702 x 156 pixels
Size 11200mm x 2500mm

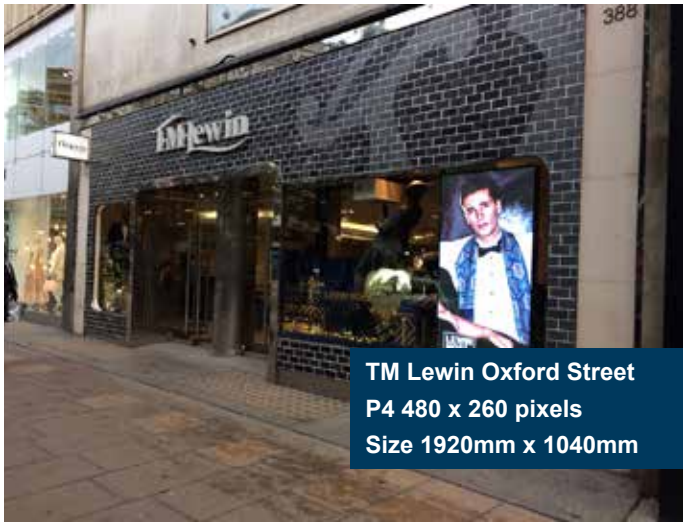
RAF Scampton
P10 128 x 32 pixels
Size 1280mm x 320mm

Salisbury FC
P6.67 672 x 384 pixels
Size 4480mm x 2560mm

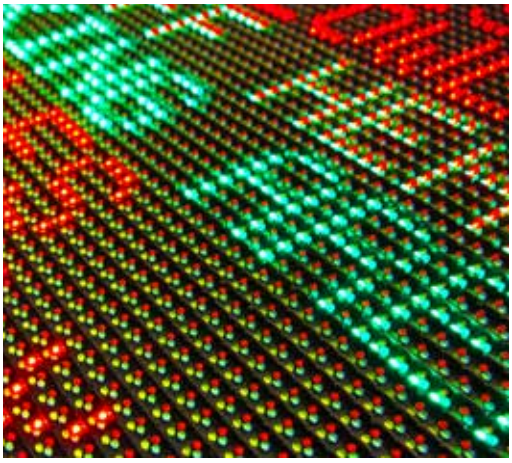
Mercedes
P2.5 1536 x 768 pixels
Size 3800mm x 1920mm



Club 3000 Bingo
P2.5 1792 x 960 pixels
Size 4480mm x 2400mm



TM Lewin Oxford Street
P4 480 x 260 pixels
Size 1920mm x 1040mm



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