eyevis new DLP® Rear Projection Series based on LED Light Source

- Low maintenance
- Eco friendly
- Outstanding image quality
- Low operating costs
- Instant start and restart - no more waiting time
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Introduction

Nowadays in every modern control room a central display medium is used in order to provide an immediate overview on the processes and monitored data to all operators and the management. In case of failures or events, everyone in the control room can immediately see what is going on and can react very quickly in order to solve the problems on an urgent basis. The various technologies used for such display systems range from Plasma displays, LCDs to modular DLP rear projection units. The most suitable display technology for control rooms is DLP rear projection, as the gap between the individual modules is smaller than with others. In addition to that, this technology does not suffer from burn-in or image retention of static images, as with Plasma or LCDs (a detailed comparison of these technologies can be found in the dedicated white paper). Up to now the rear-projection cubes used lamps for the illumination of the projection, the colours of the image were created by a spinning colour wheel (c.f. figures 2 & 3).

These lamp systems are also available as redundant versions, i.e. if one lamp fails the system automatically switches to a second lamp. The downtime is minimal (switching time of approx. 10 seconds from one lamp to the other) but the UHP lamp needs a certain time to heat up. Therefore, a fully bright image is not available before approx. 30 seconds. Also the broken lamp has to be replaced in order to bring the automatic double lamp system back in operation again. The MTBF of these lamps strongly depends on the lamp power (100-120 W lamps, 8,000-10,000 hrs, 132-150 W lamps, 6,000 hrs, higher rated lamps have an even lower MTBF). This makes the lamps the component of the system which is most likely to fail. A second consumable of lamp-based is the colour wheel, which has an MTBF of approx 30,000 hrs.

eyevis being a pioneer in the fields of DLP® technology based professional projection system since 1997, began to develop a solution that runs without consumables already in 2005. This development lead to the world’s first LED-lit rear projection cube which was showcased first on ISE 2009 in Amsterdam.

With the new LED lamp lit cubes, these two weak points could be eliminated, since these systems do not use colour wheels and UHP lamps. The LED light source used for the cubes has a MTBF of >60,000 hrs. In addition to that, the image quality could be improved, as the colour representation and the colour stability over the operating time is decisively better than with traditional lamp systems.

In this paper we will explain the benefits of this new technology and explain how it works in detail.

) eyevis was the first to establish rear projection cubes based on TI’s DLP® technology in control room applications
) eyevis has the longest experience with DLP® cubes used in 24/7 operation
) eyevis was the first to present an LED-lit rear projection cube on the market. The new LED cube series is a proprietary development by eyevis and manufactured in Germany.
1 What remains unchanged

1.1 DLP® Technology

The new LED cube shares all benefits of the DLP® technology, just like conventional lamp-based cubes. Therefore there has not been a necessity to create an absolutely new technology to generate the image. The technology has been only adapted to be operated with LED light sources.

The DMD™ Chip used in the new LED cubes is exactly the same type as in any other DLP® cubes. Compared with traditional lamp-based cubes, LED-based DLP systems do not require wear parts like colour wheels and lamps.

Ever since, eyevis had the widest range of resolutions and screen diagonals available. This will also be the case with the new LED based system. The resolution of the LED cubes ranges from 1,920 x 1,200, 1,920 x 1,080, 1,600 x 1,200 to 1,400 x 1,050 and 1,024 x 768 pixels. As a standard screen, the CrossPrism screen will be used, as this screen has turned out to be the best solution for control room applications.

- Well proven DLP® image processing technology
- So the only difference between LED cubes and lamp-based cubes is the light source used for the rear projection.
- Widest range of cube sizes, resolutions, options and accessories

2 What’s new

2.1 The housings

The housings were modified in order to make them less deep than lamp-based versions. The rear-panels of the new cubes were also re-designed for simpler and quicker handling in case of maintenance. The housings are made out of solid and robust powder-coated aluminium and are pre-mounted in the factory. This stable construction allows fast and simple installation of the cubes. The system can even be mounted and dismounted several times, for example if the control room has to be moved to another location. All other interior components are shipped pre-adjusted and pre-mounted in the cube.

The screens are pre-mounted on the special screen frame in the eyevis factory, using the eyevis clipping method. This makes the installation of the screens very comfortable compared with other systems on the market. Even in case of screen damage the screens can be exchanged very quickly. The eyevis clipping method has been developed in order to compensate for changes of the size of the acrylic screens caused by changes in temperature and humidity. Other screen holding systems which are offered by other vendors do not have the possibility to compensate such variations in temperature and humidity. This may result in falling off of the screen, or a bowed screen which causes a distorted image.

- Self supporting, robust, industrially designed housings made of powder-coated aluminium
- Pre-mounted shipment of the cubes allows simple and fast installation
- Separated back plane allows simple access to every interior component
- Different screen alternatives. eyevis clipping method compensates for climatic-related changes of the screens.
2.2 The input box
With the introduction of eyevis’ new LED cube series there has also been a
change of the input box version of our cubes. The new input box comes
with a modernised control display, a 5V power outlet for optical
transmitters and additional input possibilities with the optional Scaler
Board.

-> Newly designed input box for eyevis cube series
-> Optional Scaler Board for the input box with additional inputs,
scaling function and matrix control up to a cube array of 10x10.

2.3 The projector
The most decisive innovations of the LED cube series can be found in the
projector. The device was completely new designed in order to match the
requirements of the LED technology best. Compared with the projection
engines of the traditional lamp-lit cubes the LED projector contains totally
new components and provides an improved exterior design.

The projection engine consists of an optical unit, electronic boards, fans,
power supplies, a DMD™ chip, LED lights and an input box mounted on a
six axis engine carriage for an easy and quick geometrical adjustment. Optionally, this geometrical
adjustment is available as motorised version for an adjustment via IR remote control or PS/2. With this
motorised adjustment there is a scaler board, as with the front-access option.

-> Special service lids grant access to every component of the projector
-> Innovative components inside the device, new illumination technology, new optical lens
system, new cooling system.
-> Precise geometry correction thanks to 6-axis adjustment carriage (optionally motorised).

2.4 LED illumination technology
LED technology for rear-projection engines is a new type of solid light source that
combines the benefits of LED and laser technology. The LEDs used in the eyevis
engines are one of the most reliable light sources in the world today. The LEDs
have passed a number of rigorous environmental and mechanical stress tests,
including mechanical, shock, vibration, temperature cycling and humidity.
Unlike conventional LEDs, which emit into an epoxy based encapsulant, the
LEDs used in the eyevis systems emit directly into air, resulting in significantly
longer life-times. The LEDs have very low failure rates and median life-times
that are well above 100,000 hours under extreme, high current operating
conditions as well as 24/7 usage. All LEDs in the eyevis engine are RoHS
compliant and 100% free of hazardous materials, including lead and mercury.

High intensity mercury arc lamps used in video projection, such as rear-projection, front projection, etc.
contain 10 to 50 mg of mercury. These lamps fade during their life-time and eventually burn out and
require a replacement every 2,000 -10,000 hours. When these lamps are replaced or the products are
discarded at the end of its life, it must be discarded in an environmentally safe manner to avoid
contaminating the environment. Now you can imagine with millions of rear-projection cubes, TV, front
projectors etc. in the world how many millions of lamps have to be replaced each year.
With the use of the new LED technology in the rear-projection engines, we reduce hazardous waste and overall costs of ownership.

- The LED light source is no longer a wear part as projection lamps were
- The system uses three Light Emitting Diodes (red, green and blue)
- Each LED has ONE light emitting area of 11.96 mm² (for HD version / for other resolutions the area is different to fit the optical requirements).
- Cooling is achieved through separate heat-pipe cooling for each LED
- Single LEDs can be replaced or the complete RGB LED light block.

**LED Structure and Design**

- **Photonic Lattice Light Emitting Diodes**
  - Intricate nano-structure embedded in the LED
  - Allows to efficiently scale die sizes, enabling ultra-high performance LEDs

- **Enables Large, monolithic LEDs**
  - Traditional LEDs are only up to 1mm in size
  - Higher system level efficiency than array of small 1 mm LEDs
  - LED size and aspect ratio tuned to micro-display and light engine Industry-leading thermal management architecture
  - Precise Optical Integration
  - High brightness, high reliability

  - Homogeneous illumination of the DMD™ chips guarantees stable illumination for the complete life-time of the cube, respectively a matrix of cubes in a video wall

  - Improved colour stability

  - No use of LED clusters (illumination modules using a matrix of LEDs)

  - No extensive optical combination necessary as with cluster LEDs

  - Less power consumption and minor thermal load than cluster systems

  - Less complex adjustment since fewer components are involved than in cluster systems

**2.5 Optical path in LED-lit projection systems**

When we have a closer look at the illustrations of the optical light path of the two technologies we can see several differences. First of all, we can observe that the light path in the UHP system is longer than with LEDs. Then we see that there are more components necessary in the UHP-based system to ensure the optimal light path. The RGB cycle frequency in UHP systems is much longer compared with LED systems. In UHP systems the frequency is determined by the colour wheel speed. The RGB frequency of eyevis LED projection engines is caused by the pulse rate of the LEDs.
Compared with traditional UHP lamp systems the LED projection engine has numerous advantages. Not only that the life-time of the light source is more than 5 times higher, but also that with the colour wheel, an additional consumable part could be removed with this technology. Besides these mentioned life-time factors, the LED cube has better colour representation, larger colour gamut and better brightness and colour stability. The longer life-time and the better brightness and colour stability of the system dramatically reduce the interval times for service and maintenance of the system. Another aspect to be taken into consideration with the new LED technology is the environmental benefit. The components have a higher life-time, hence less waste is produced and the LEDs do not contain harmful mercury like UHP lamps. Traditional UHP lamp systems required some time to heat up the bulbs and to achieve their full brightness, with LED lit systems you instantly have the full brightness when switching on the system.

- Eliminates colour wheel from DLP systems
- Fewer moving parts improves overall reliability
- LED speed allows higher oversampling rate, which eliminates colour separation artefacts ("Rainbow effect")
- Single emission area per colour allows for single-lens collection and simplified optics
- Extremely high light output from a compact emitting area
- 100%, uniform surface emission for high collection efficiency and low optical losses

LED Benefits in Projection Systems

- Deep, saturated Colours
  - Colour gamut: 180% of UHP lamp with RGB colour wheel
  - Human eye perceives saturated colours as brighter
- Precise, Digital control benefits high speed DMDs (DLP)
  - Control of LED Brightness levels increases dynamic range for a better contrast
  - Fast “On” and “Off” switching – sub-1us level
  - A True Digital light source for Digital Light Processors!
  - Colour and brightness adjustment without image bit depth reduction
- Fast switching properties enable electronic control of colour points and light intensity on a frame by frame basis
- Wide colour gamut: RED 625 nm, GREEN 525 nm, and BLUE 462 nm typical dominant wavelengths
- RoHS compliant (lead-free)
2.6 Cooling System

Heat pipes employ evaporative cooling to transfer thermal energy from one point to another by the evaporation and condensation of a working fluid or coolant. When one end of the heat pipe is heated the working fluid inside the pipe at that end evaporates and increases the vapour pressure inside the cavity of the heat pipe. The latent heat of evaporation absorbed by the vaporisation of the working fluid reduces the temperature at the hot end of the pipe.

![Figure: Heat-pipe Cooling](image)

2.6.1 Structure, Design and Construction

The cooling systems in eyevis LED projectors conduct the heat through heat-pipe systems (one per LED) to a heat exchanger where the heat is dissipated with fans.

A heat pipe consists of a sealed pipe made of a material with high thermal conductivity. Due to the partial vacuum that is near or below the vapour pressure of the fluid, some of the fluid will be in the liquid phase and some will be in the gas phase. Having a vacuum eliminates the need for the working gas to diffuse through another gas and so the bulk transfer of the vapour to the cold end of the heat pipe is at the speed of the moving molecules.

As heat pipes need no forced circulation, they contain no mechanical moving parts and hence typically require no maintenance.

The advantage of heat pipes is their great efficiency in transferring heat. They are a much better heat conductor than an equivalent cross-section of solid copper.

2.6.2 Advantages of eyevis LED Cube Cooling Systems

Permanent control of the LED temperature: 3-channel control, temperature sensor is positioned directly on the LED.

Innovative active power reduction, i.e. in the improbable event of a failure of the cooling system or if the ambient temperature exceeds tolerable values, the system automatically reduces the power of the LEDs. The cubes remain in operation and a picture is still visibly displayed.

In total **seven temperature sensors** on all critical components like power drivers (LED driver), power supplies, etc. guarantee a trouble-free operation of the system.

- Highly dynamic ⇒ fast and efficient heat dissipation
- No forces circulation required ⇒ no mechanical moving parts
- Maintenance-free, requires no replenishment of liquids etc.
- No extra control necessary, system sends fully automatic status messages in case of failures
- Operable in almost any orientation without the danger of leaking liquids
- Highly reliable protection from overheating of the LEDs compared with purely air-cooled systems
Heat-pipe cooling systems can be operated in any position and even in vibrating environments, without the risk of leaking liquids

2.7 Advantages of the LEDs compared with traditional UHP lamp systems

- Life-time: 60,000 hrs for the LEDs
- Best colour gamut
- No mercury like in UHP lamps, less waste, eco-friendly
- Colour temperature adjustable
- No consumables like colour wheel or lamps
- Improved colour/brightness adjustment
- Instant brightness, no heating up sequence
- Less maintenance costs
- Excellent for TV applications
- Dynamic brightness and colour control
- Less interruptions caused by lamp replacements
- Better brightness stability: UHP lamps lose brightness faster and more in a short time
- Each of the three LEDs can be adjusted separately and very precisely, therefore colour adjustment is much more efficient and the colour depth of the displayed content is not affected.

2.7.1 Realistic Performance Comparison: UHP Lamp vs. LED

![Life-cycle comparison UHP vs. LED](image)

Regarding the values for brightness given in leaflets and brochures, there are many different brightness parameters used. For example, some vendors use ANSI Lumen, which is normally measured as the light output directly at the projector, but does not tell us anything about the real brightness of the screen surface of the cube. The appropriate value to specify the real brightness of a rear-projection cube is candela per square metre [cd/m²].

Many manufacturers give very high figures of brightness in their brochures, but it is questionable whether this is really the brightness you will get from the device? If we compare lamp-based with LED-based systems, we can observe that the brightness characteristic of the two technologies behaves very differently over time. For example, only after a few weeks in operation the loss of brightness of lamp-based systems is 20-30%. Now you can imagine how much brightness remains after 6 months from the initially indicated values.
With LED based system the brightness stability over life-time is much more stable and LEDs offer consistent performance over time. By the way, serious manufacturers give realistic figures for their technical data or even a little lower.

### 2.7.2 Colour space comparison: LED vs. UHP cube

![Colour Space Comparison Diagram](image)

The colour space is decisively larger with LED based systems, which means that more colours can be represented and therefore the system is more accurate in displaying the colours. The displayed source will be displayed 1:1 in terms of colours.

*The colour gamut of the LED projection technology is 1.8 times larger than with traditional lamp-lit systems*

### 2.7.3 Spectral distribution

![Spectral Distribution Diagram](image)

Compared with the spectrum of UHP systems, LED based systems show a much better representation of red, which enhances the colour gamut of the system. The non-overlapping spectral representation of the primary colours R, G and B allows a very precise adjustment of the colour temperature.
2.8 Reliability and Stability

In applications like command and control rooms, which are running 24/7, it is very important to have a very reliable system, especially when important information is displayed which should be available continuously. As eyevis works more than 15 years in this field, we have integrated many features to increase the redundancy of the systems.

- Short-circuit-proof power supplies
- The system is based on three individual channels for R, G & B LEDs, i.e. if one LED fails, the others are not affected and remain in operation. A picture is still displayed on the cubes
- Separate control channels for each primary colour
- Resilience through 3-channel concept of power supplies, LED driver and LEDs

MTBF/life-time

As already explained in 24/7 operation a key point is the reliability of the used systems, therefore any components within such a system have to as reliable as possible. As usual eyevis is using high-end components in order to assure long-term operation and reliability. The life-time and MTBF of the different components is as follows:

- **MTBF:**
  - LED 60,000 hrs (according to manufacturer)
  - Power Supply 165,000 hrs (according to manufacturer)
  - DMD™ chip 650,000 hrs (according to Texas Instruments)
  - Fan 80,000 hrs (according to manufacturer)

- **Median life-time:**
  - DMD™ 150,000 hrs (under certain operating conditions)
  - LED 60,000 hrs (< 80° C red, < 120°C green and blue, according to manufacturer)

3 Colour Alignment

New user-friendly and intuitive feature:

**ACT Auto-Colour-Tracking**

As mentioned above, the new LED technology offers longer lasting colour stability as well as more accurate colour adjustment possibilities. The automatic colour and brightness correction is more than a marketing phrase with the LED based engine. Also the adjustment within the different cubes of a video wall becomes reality and very easy, thanks to the new innovative developments of eyevis. For the users of such video wall systems the adjustment of brightness and colour are more comfortable and easier, therefore the system can be adjusted very easily. The newly developed Multi-Cube Colour-Brightness Adjustment option is a tool that allows full-automatic adjustment and alignment of all cube modules of a combined large screen wall. As a result of this, re-adjustments can be made much easier and in shorter time. Hence, longer training periods for the operators and extra costs for trained technicians are no longer necessary.

- Internal brightness measurement direct in the optical path before the DMD chip.
• Brightness adjustment is performed directly with the LEDs themselves → advantage: the dynamic range of the displayed image is not affected, hence a stable image quality is guaranteed.

• With several cubes in a combined video wall the measurement is done in every cube separately. The values of the individual cubes are automatically aligned with reference to the values measured in the “weakest” cube of the video wall. This allows constant brightness and colours over the entire wall.

• If there is an abnormal readjustment detected during the alignment process, this can be caused by an LED module which is about to fail. In this case the performance of the potentially defective LED can be reduced to lower values (safety mode) without loss of the primary colour itself to secure the operation of the entire system. This possible failure of the LED can be instantly notified with status messages sent by the eyeCube software. With the optional eyecon wall management software these status messages can be sent via SMS or e-mail.

• LED segment adjustment for colour temperature
  - 3,200 K
  - 6,500K
  - 9,500 K
  In between these values there is also a fine adjustment possible.

3.1 Automatic Colour Calibration

The eyevis LED cube projectors provide a special method for colour calibration of single or multiple channels. This process is specially aligned to the spectral characteristics of the LEDs and therefore allows a very precise calibration of colours. The primary colours are continuously controlled by an internal sensor which automatically adjusts these through several channels in order to achieve a homogeneous colour impression. The image signal itself is not affected by this process; hence the original colour depth of the signal remains unchanged.

Example:

Step1:

• The Picture below shows a 3x2 video wall. The cubes vary in colour and brightness, due to diverging settings of the projection engine.
- The differences in colour can also be seen in the figure below. The curves of the two cubes show differences in intensity over the spectrum.

![Intensity vs Wave Length](image)

**Step 2:**
- eyevis newly developed multi-cube colour calibration measures colour and brightness directly in the light path of the projector. Within short time the two cubes in this example look exactly the same, showing an homogenous image over the complete screen surface. The reference values for this adjustment of multiple cubes within a video wall are always taken from the "weakest" unit of the wall.

![Image of cubes and calibration](image)
The resulting homogeneity of the displayed image can also be seen in the figure below. The two curves of the individual cubes run almost parallel, hence no perceptual difference in colour.

### 3.2 EC-Lcontrol - The software tool for LED cube colour adjustment

#### 3.2.1 Automatic adjustment with the EC-Lcontrol

In contrast to UHP lamp-based systems, the innovative eyevis colour management enables separate control for every LED and therefore for every primary colour. In terms of colours, the white point of the light source can be determined very precisely. This guarantees a constant colour intensity of the LED light source.

All eyevis LED cubes and projectors have an internal factory-calibrated sensor which continuously measures colour and brightness of the LED light source directly in the optical path before the DMD chip. The collected values for colour and brightness of every channel, for example in multi-channel projections or multiple cubes in a video wall, can be easily read, collected and processed by the user with the eyevis colour management software. The inter-communication of the individual channels, which has been a standard in eyevis products for years now, determines the highest possible brightness which can be realised for a certain white point parameter on all channels.

With a single mouse-click, the colour values of all channels get adjusted to this parameter. This results in a homogenous representation of colour and brightness over the entire projection area. This procedure does not require the display of test patterns for the calibration. Hence, the displayed information does not need to be changed for the colour management, there is no disturbance of the usual operation of the display system.
3.2.2 System analysis / reporting

With the newly developed color adjustment tools of the LED cube series, there is the possibility to read out different datasets of information from the system. When read out, this information can be visualized over Excel charts and diagrams. This data includes parameters, like the temperature course inside the cubes (internal and external temperature sensors), how often the system has automatically re-adjusted the color and brightness, the deviation of the color and brightness to the reference value, temperature of each individual LED, can be obtained on a daily basis if required. With this system, you have an overview at every stage on how your system is working. In case of problems with the system, the errors can be clearly identified and if the system has launched the adequate reaction.

4 “Colour-Rescue-Control”: Process for prevention of information losses at failures of illuminants at digital projectors

4.1 Operating principle

Digital rear projection cubes are the main visualization systems used in command and control rooms to display processes, video cameras, etc. Usually these projection systems use lamps as illumination units, these lamps have a certain lifetime, but it is known that these lamps can fail before reaching their end of life-time. This means if the lamp fails, there is no image anymore. For that reason automatic dual lamps were developed to switch to a second lamp when one lamp is failing. With that higher degree of reliability was achieved.

The new systems using light emitting diodes (LEDs) as light source, typically do not have a single light source for illumination, but three individual surface LEDs, each for one primary color (red, green, blue). At the eyevis system, the individual LEDs are driven by separated electronic paths to avoid that a failure of a part of the system affects the whole light source. Each LED is typically designed that each has its own power supply and driver unit. With that it is assured, that a failure of one LED or power supply assures the operation of the two other LEDs. The viewable image of the projection is simply reduced by the fundamental color of the failed LED. In special applications the failure of a primary color can result in loss of important information, for example a displayed value or operating condition is shown in a primary color and this color fails it cannot be seen anymore. This results in a safety risk in the line operation or the surveillance. Eyevis has developed a system to solve the problem of information loss by displaying the failed primary color by the remaining two color LEDs. For example if the red color fails, you will see black where red should be displayed. The system is now able to compensate the loss of the red color that everywhere, where the image should be red, green or blue or both colors are displayed. With this system it is assured that the information is still viewable even if it is not in its original color. It is also possible to display the missing information as blinking or as color change of the remaining two colors in order to attract more attention. It is even possible to compensate the failure of two primary colors by the remaining color. Therefore the system will still be in operation if one or two primary colors fail. The missing information caused by the failure of a primary color will be compensated by the remaining primary colors and can be highlighted by dynamical changes.
4.2 How it works

**Normal Operation:** The original image with all primary colours (red, green, blue)

![Image](image1.png)

**Failure (e.g. primary colour “red“):** Red LED fails (for example). The red image content disappears. The remaining image is displayed without the red proportion in the secondary colours. This is especially dangerous if the red content shows important information for the safe operation of a system.

![Image](image2.png)

**Solution:** In order to show the complete information included in the image, eyevis developed a special process which automatically changes the image information to monochromatic mode. Now, the displayed image again includes all relevant information. The system can remain in operation until the broken LED is changed. The values for this colour replacement can be individually adjusted according to the customer’s image content. **In this example the system was switched to “secure cyan mode”**

![Image](image3.png)
5 Available Sizes and Resolutions

Native XGA (1,024 x 768 pixels) resolution:
► 50” EC-50-LXT
► 67” EC-67-LXT
► 70” EC-70-LXT

Native SXGA+ (1,280 x 1,024 pixels) resolution:
► 50” EC-50-LSXT
► 65” EC-65-LSXT
► 70” EC-70-LSXT

Native SXGA+ (1,400 x 1,050 pixels) resolution:
► 50” EC-50-LSXT+
► 67” EC-67-LSXT+
► 70” EC-70-LSXT+
► 80” EC-80-LSXT+

Native HD (1,920 x 1,080 pixels) resolution:
► 60” EC-60-LHD
► 67” EC-67-LHD

Native UXGA (1,600 x 1,200 pixels) resolution:
► 70” EC-70-LUXT

Native WUXGA (1,920 x 1,200 pixels) resolution:
► 56” EC-56-LWXT
► 70” EC-70-LWXT

6 Optional Features

eyevis cubes offer a wide range of options and additional features as well as customized solutions. These options and additional features make eyevis perfect visual solutions a first choice for your video wall system. Many of these options can be upgraded in a future step. This means your system has the possibility to grow with your growing requirements.

Scaler board max. 2x DVI, 2x RGB, 1x YC, 2x FBAS, 1x YUV (Component), including internal split functionality for cube wall arrays up to 10x10 units
Front-access for option for front side access to the housing for service and maintenance
The front-access option includes motorized geometrical adjustment with remote control or PS2.
Multi-cube colour-brightness automatic adjustment (ACT)
Network board
Anti-dust housing with over pressure
Special solutions: rail basement, anti-vibration basement, video wall structures on hover cushions, ...
Panelling for the steel basements
Connection to room climate control systems
Earthquake certification
## Specifications

### 7.1 Projection Engine

<table>
<thead>
<tr>
<th>Resolutions</th>
<th>XGA (1,024x768), SXGA (1,280x1,024), SXGA+ (1,400x1,050), HD (1,920x1,080), UXGA (1,600x1,200) and WUXGA (1,920x1,200)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Projection Engine</strong></td>
<td>500 to 700 Lumen (depending on resolution)</td>
</tr>
</tbody>
</table>
| XGA (type: LXT)   | 50": N.N.  
67": N.N.  
70": typ. 164 cd/m (max. 205 cd/m)                                                                 |
| SXGA (type: LSXT) | 50": typ. 370 cd/m (max. 410 cd/m)  
65": typ. 185 cd/m (max. 235 cd/m)  
70": N.N.                                                                 |
| SXGA+ (type: LSXT+) | 50": typ. 370 cd/m (max. 410 cd/m)  
67": typ. 175 cd/m (max. 220 cd/m)  
70": typ. 164 cd/m (max. 205 cd/m)  
80": typ. 120 cd/m (max. 135 cd/m)                                                                 |
| HD (Type: LHD)    | 60": typ. 217 cd/m (max. 279 cd/m)  
67": typ. 186 cd/m (max. 235 cd/m)                                                                 |
| UXGA (Type: LUXT) | 70": typ. 164 cd/m (max. 205 cd/m)                                                                 |
| WUXGA (Type: LWXT) | 56": typ. 280 cd/m (max. 350 cd/m)  
70": typ. 179 cd/m (max. 224 cd/m)                                                                 |
| **Contrast**      | typ. 1,500:1 (static roll-on / roll-off)                                                                         |
| **Uniformity**    | >90%                                                                                                              |
| **Colour Gamut**  | 1.8 times larger than with UHP lamp with RGB colour wheel                                                          |
| **Power consumption** | approx. 230W                                                              |
| **MTTR**          | <15 min.                                                              |
| **MTBF**          | >55,000 h                                                             |
7.2 LED Cube Dimensions

<table>
<thead>
<tr>
<th>Type</th>
<th>Screen Diagonal</th>
<th>Dimensions in mm (WxHxD) (including screen)</th>
<th>Screen size in mm (WxH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC-50-LXT</td>
<td>50&quot;</td>
<td>1000 x 980 x 620</td>
<td>1000 x 750</td>
</tr>
<tr>
<td>EC-67-LXT</td>
<td>67&quot;</td>
<td>N.N.</td>
<td>N.N.</td>
</tr>
<tr>
<td>EC-70-LXT</td>
<td>70&quot;</td>
<td>1400 x 1270 x 750</td>
<td>1400 x 1050</td>
</tr>
<tr>
<td>EC-50-LSXT</td>
<td>50&quot;</td>
<td>1000 x 1030 x 800</td>
<td>1000 x 800</td>
</tr>
<tr>
<td>EC-65-LSXT</td>
<td>65&quot;</td>
<td>1280 x 1335 x 850</td>
<td>1280 x 1024</td>
</tr>
<tr>
<td>EC-70-LSXT</td>
<td>70&quot;</td>
<td>N.N.</td>
<td>N.N.</td>
</tr>
<tr>
<td>EC-50-LSXT+</td>
<td>50&quot;</td>
<td>1000 x 980 x 620</td>
<td>1000 x 750</td>
</tr>
<tr>
<td>EC-67-LSXT+</td>
<td>67&quot;</td>
<td>1364 x 1243 x 750</td>
<td>1364 x 1023</td>
</tr>
<tr>
<td>EC-70-LSXT+</td>
<td>70&quot;</td>
<td>1400 x 1270 x 750</td>
<td>1400 x 1050</td>
</tr>
<tr>
<td>EC-80-LSXT+</td>
<td>80&quot;</td>
<td>1600 x 1480 x 1000</td>
<td>1600 x 1200</td>
</tr>
<tr>
<td>EC-60-LHD</td>
<td>60&quot;</td>
<td>1344 x 956 x 820</td>
<td>1344 x 756</td>
</tr>
<tr>
<td>EC-67-LHD</td>
<td>67&quot;</td>
<td>1460 x 1054 x 850</td>
<td>1460 x 821</td>
</tr>
<tr>
<td>EC-70-LUXT</td>
<td>70&quot;</td>
<td>1400 x 1270 x 750</td>
<td>1400 x 1050</td>
</tr>
<tr>
<td>EC-56-LWXT</td>
<td>56&quot;</td>
<td>1209.5 x 968 x 743</td>
<td>1209.5 x 756</td>
</tr>
<tr>
<td>EC-70-LWXT</td>
<td>70&quot;</td>
<td>1520 x 1190 x 800</td>
<td>1520 x 950</td>
</tr>
</tbody>
</table>
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