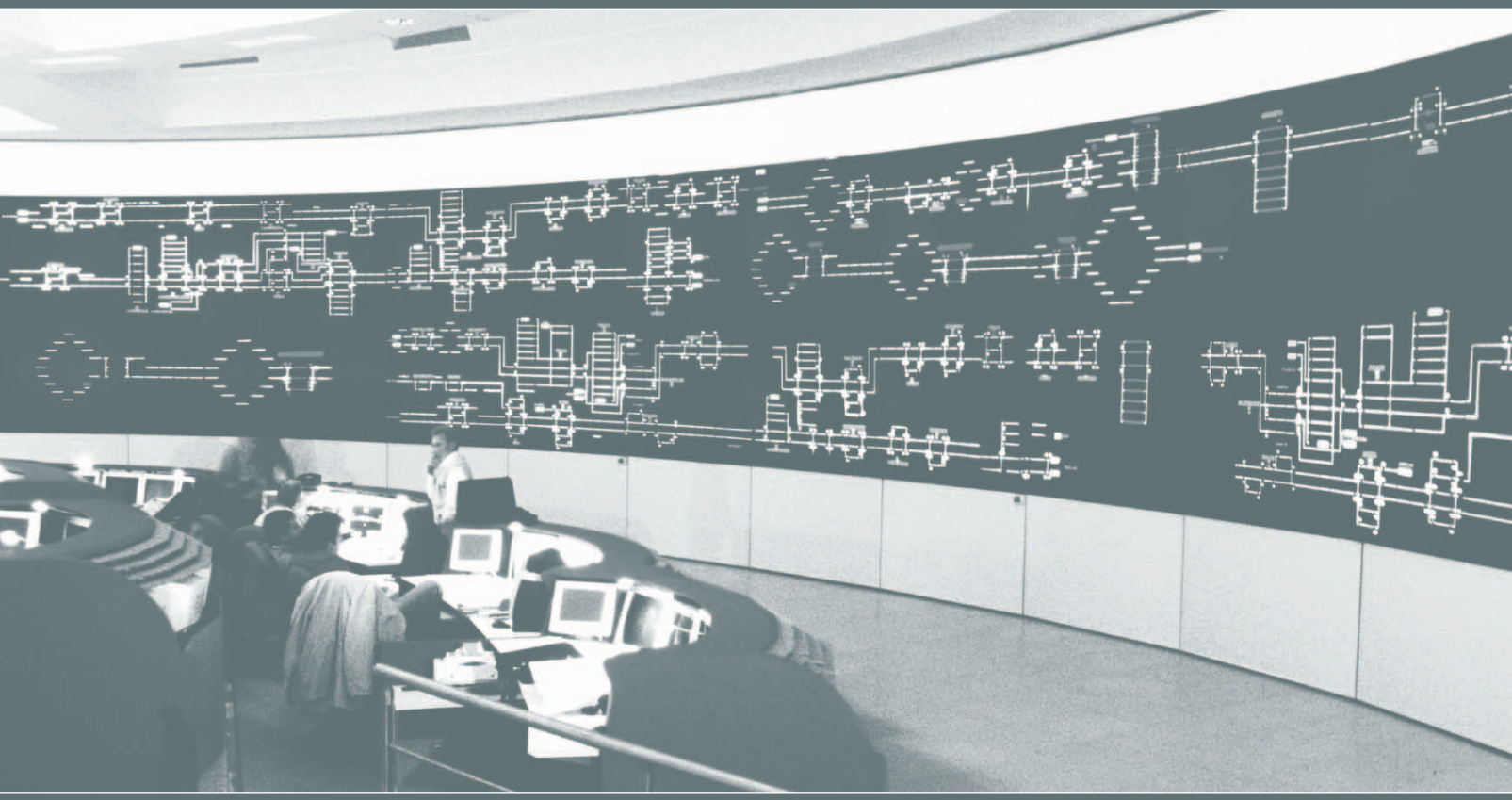
dnp control room displays



Screens of the art

Specifying control room displays

The screen is the focal point of the entire control room system. It is the point of delivery for the mission critical information. This makes the process of specifying screens extremely important.

A bad or wrongly specified screen can ruin the image. A good screen can dramatically enhance the quality of the projected image – and display sharp, high-contrast images under the ambient light conditions that characterize the ergonomically correct control room.

This is why the world's leading cube manufacturers use optical rear projection screens from dnp for their cube walls and control room display systems.

While traditional screens are passive – optical rear projection screens from dnp are dynamic. The dnp screen is an active partner that allows you to focus, enhance and control the projected images. And helps you battle critical issues such as ambient light, reflections and difficult viewing angles.

With dnp's extensive programme of control room displays you can work dynamically with essential parameters including:

- screen size, resolution, format
- contrast, gain, and viewing angles
- built-in depth and focal length
- brightness and colour uniformity
- humidity, temperature and material stability

This brochure will help you identify the ideal mix of screen parameters – and to specify the correct screen type and model for each individual control room project.

dnp provides you with more options

dnp offers the world's most extensive range of screens for different control room environments. Working with dnp, you have access to 10 different screen types, which are available in more than 100 versions. This allows you to optimize your displays to each individual control room environment.

dnp Black Bead Screens offer exceptionally good vertical and horizontal viewing angles and sharpness, even when viewed at close proximity – requirements essential to modern control room environments.

Screen size, resolution and format

Screen Size

The size of the screen is normally the first thing to be determined when designing a control room. The screen size depends on two issues: the amount and form of information to be displayed; and the viewing positions of the operators.

The important thing is that all information displayed should be easy for the human eye to view, read and understand. Make a pre-design of the graphical interface, and use the below guidelines from the DIN standard to calculate the screen size:

- the viewing distance should not be more than 200 times the height of the character size
- the viewing distance should not be less than 2 x nor larger than 8 x the height of the total image. The ideal viewing position is 4 x the image height

Format

When selecting a screen format, it is very important to fit the native format of the engine. By forcing the engine to run in a different format, you will lose image definition, which is a key parameter in control room displays.

- for XGA (1024 x 768) projectors always use a screen in 4:3 aspect ratio
- for SXGA (1280 x 1024) projectors always use a screen in 5:4 aspect ratio
- for UXGA (1600 x 1200) projectors always use a screen in 4:3 aspect ratio
- for SXGA+ (1400 x 1050) projectors always use a screen in 4:3 aspect ratio

Resolution

The ideal screen size and thus viewing distance also depends on the resolution of the projector.

- for XGA a maximum viewing distance of 6 x the image height is recommended
- for SXGA a maximum viewing distance of 4.5 x the image height is recommended
- for UXGA a maximum viewing distance of 3.8 x the image height is recommended
- for SXGA+ a maximum viewing distance of 4.4 x the image height is recommended

All dnp screens have a native resolution, far higher than even the highest resolution projectors can currently deliver. This ensures that each individual pixel projected by the projector can be clearly perceived on the screen.

Contrast, gain and viewing angles

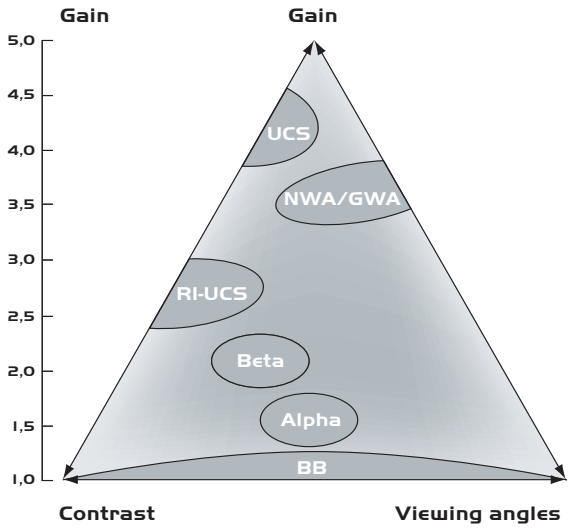
When specifying a control room screen, it is important to find the ideal balance between contrast, gain and viewing angles as these parameters affect each other: enhanced contrast and wider viewing angles will automatically result in lower gain; enhanced gain can be obtained by accepting reduced contrast and viewing angles – and vice versa.

dnp has designed a wide range of optical screens for different control room environments. In order to specify the ideal screen for your specific installation, you should begin by identifying the system requirements:

- how bright should the image be for the viewer?
- what should the image contrast ratio be?
- what is the level of ambient light in the room?
- where are the operators seated relative to the screen?

Most of these data are normally available when you design your system. The remaining data can be calculated by using the equations for image brightness and image contrast ratio.

It is important to realize that if the viewing room has a high level of ambient light it is the screen reflection



alone that defines the image contrast and not the projector contrast ratio. Therefore a key parameter in control room design is to control the ambient light in the viewing room and choosing a screen with the lowest possible front surface reflectance.

$$\text{Image brightness} = \frac{(\text{screen gain} \times \text{projector brightness})}{(\text{screen surface area} \times \pi)}$$

When calculating image brightness, always use the screen gain related to the position of the operator in the most difficult viewing position (e.g. 30° to the side of the screen) – not the screen peak gain.

Formula

$$\text{Image Contrast Ratio} = \frac{B + R}{\frac{B}{C} + R} :1$$

Definitions

B = Image brightness

R = Screen reflection of ambient light

C = Projector contrast ratio

Example

Image brightness (B) = 400 Nit

Screen reflection of ambient light (R) = 10 Nit

Projector contrast ratio (C) = 500:1

$$\text{Image contrast ratio} \quad \frac{B + R}{\frac{B}{C} + R} :1 = \frac{400 + 10}{\frac{400}{500} + 10} :1 = 38.0:1$$

Built-in depth and focal length

The built-in depth is a critical issue in most control rooms. The key issue is to minimize the cube depth without losing brightness uniformity. This makes the screen focal length a key parameter.

Today, most engines are equipped with optics with a lens throw ratio (LTR) in the range of 0.6 – 0.9:1. This means that the projection distance is shorter than the screen width. The built-in depth can be further reduced by almost 40% by "folding" the light path with an optical mirror.

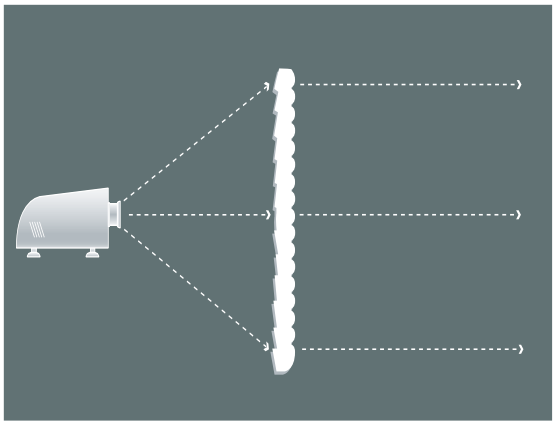
It is very important to choose a screen focal length which matches the projection distance of the projector, in order to obtain brightness uniformity with all neighbouring screens in a cube wall.

With dnp's extensive range of screens for control rooms it is easy to make this match, as each screen type and size is available with up to four different focal lengths.

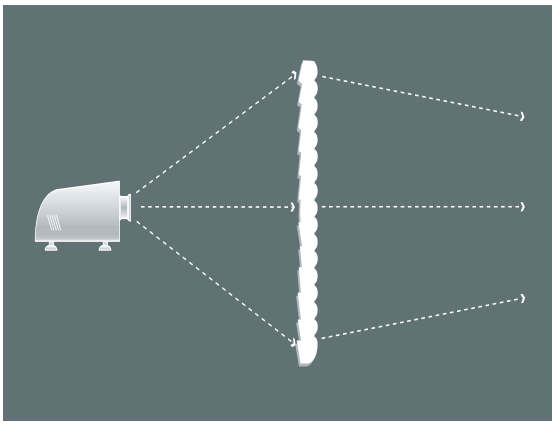
For optimum viewing, you can choose between single element screens (with two active lens surfaces) and double element screens (four active lens surfaces), using the guidelines below.

= **Double element screens:**
The four active lenses will always give you ideal brightness uniformity no matter which LTR to be used

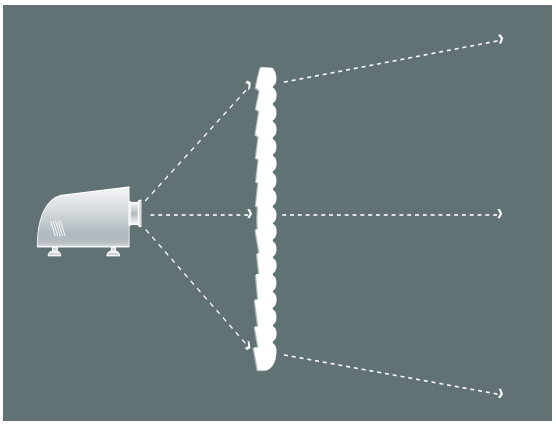
= **Single element screens:**
Single element screens provide better brightness uniformity as projection distance increases



Projection distance is equal to the screen focal length.



Projection distance is longer than the screen focal length.



Projection distance is shorter than the screen focal length.

Brightness and colour uniformity

Brightness uniformity is particularly critical in cube installations. If the viewers are positioned right in front of the wall, you need to make sure that neighbouring screens project their light perpendicular to the screen. If the screen focal length is too long or too short – thus spreading or narrowing the light – you will lose brightness uniformity.

When the operator is positioned away from the centre, however, it is important that the screens have very good viewing angles. The better the viewing angles, the better the brightness uniformity.

The dnp screen programme includes screens which allow you to enhance horizontal as well as vertical viewing angles, depending on your room design. As a basic guideline, you should follow these principles:

- **the horizontal viewing angle is the most important, if e.g. the cube system is a 2 high by 8 wide configuration, then the vertical viewing angles are less critical.**
- **the horizontal and vertical viewing angle are both important, if e.g. the cube system is a 3 by 3 configuration**

In order to specify the right screen, please see the section about viewing angles.

Another key parameter in the control room is colour uniformity. The colour uniformity is basically controlled by the engine, but is also influenced by the screen, as the screen controls the contrast of the image. Depending on which type of screen you choose, more or less image contrast can be acheived thus the colour temperature is variable. To make sure that the screens you use for your video wall has the exact same colour temperature you should follow these guidelines:

- **always specify high quality screens from the same manufacturer**
- **always specify colour matched engines from the manufacturer**

Furthermore, it is important to adjust the colours so that the engine and the screen together produce an image with colours which fit the displayed images.

Even small differences in colour can irritate the eye. And if the difference is too big, the operator will lose focus on the information.

Material stability – humidity/temperature

One of the most competitive issues in modern control rooms is to make the cube installations as seamless as possible. Today, the gap between each screen in a standard cube wall is in the range of 0.2 – 1.0 mm.

This means that you have to pay special attention to two critical issues:

- each screen must be cut with the highest precision
- the screens must react as little as possible to changes in humidity and room temperature

Today, most control rooms use air conditioning. But even the smallest changes in temperature or humidity can cause some screens to contract/expand, thus resulting in wider gaps or screen distortion, if the frame system is too rigid.

To avoid these problems – and facilitate design of near-seamless installations – all dnp screens are cut to the highest degree of precision, both in terms of nominal tolerances and perpendicularity.

Furthermore, all dnp screens are produced in materials which are as immune to variations in the projection environment as possible.

In the UCS programme, we have introduced a new material, which is even more environmentally stable than other acrylic material.

Another innovation is the glass version of the Black Bead Screen, which is designed with a lenticular glass element. As glass has very small expansion coefficients, compared to any optical plastic polymer, this is the ultimate solution for control rooms where temperature and humidity cannot be controlled sufficiently.

How to select the perfect screen

dnp has developed a complete range of screens to meet the requirements in different control room environments. All screens are optimized to work with – and enhance – the output from all single lens projectors on the market – including LCD, DLP, Light Valve, D-ILA and LCOS projectors.

Use the screen matrix to identify which screen type matches the requirements in your specific control room installation. When you have identified the screen type, you can find more detailed information in the product specification sheets.

dnp screen type	Double or single element	Max screen size in 4:3 diagonal measure [Inch]	Screen pitch [mm]
New Wide Angle Screen	Single	130"	0.25
Alpha Screen	Single	120"	∞
Giant Wide Angle Screen	Single	200"	0.50
Beta Screen	Double	120"	0.25
Ultra Contrast Screen	Double	70"	0.14
Ultra Contrast Screen – Rigid	Double	67"	0.14
Black Bead Screen – Acrylic	Double	80"	∞
Black Bead Screen – Glass	Double	67"	∞

Peak gain	Horizontal half gain angle [Degrees]	Vertical half gain angle [Degrees]	Screen contrast ratio [1]	Screen surface reflectance [2] [%]	Shortest screen focal [mm]	Screen brightness uniformity [3] [%]	Screen brightness uniformity [4] [%]	Thermal expansion coefficient [5] [10^{-5} m/m°K]	Humidity expansion coefficient [6] [10^{-5} m/m]
3.5	32	8	36:1	1.7	1600	35	46	7.8	to be adviced
2.3	18	18	32:1	0.9	1150	45	57	7.8	to be adviced
3.0	32	8	40:1	1.3	3500	35	45	7.8	to be adviced
2.0	35	12	35:1	1.5	1450	100	87	7.8	to be adviced
3.8	24	9	129:1	1.3	826	90	89	7.0	to be adviced
2.7	24	12	84:1	1.5	826	100	103	7.0	to be adviced
1.0	35	35	49:1	0.5	826	100	92	7.5	to be adviced
1.0	35	35	91:1	0.4	826	100	90	0.9	to be adviced

[1] Measured with 0.9 lens, 400 Lux ambient light level in the viewing room and 600 Lux projector light at the centre of the screen. Measured on the screen backside.
[2] Valid for diffused light. Measured with chromameter on front side of the screen at 600 Lux on screen back centre and at 200 Lux and 400 Lux on front side.
[3] Centre-to-corner brightness uniformity measured with 0.9:1 lens, dark viewing room and 600 Lux projector light at the centre of the screen. Measured on the screen backside.
[4] Centre-to-corner brightness uniformity measured with 1.2:1 lens, dark viewing room and 600 Lux projector light at the centre of the screen. Measured on the screen backside.
[5] Measured at constant relative humidity level.
[6] Measured at constant temperature of 20°C.

Total Quality Management

Control room screens from dnp are produced to the highest quality standards within the industry. And dnp has successfully passed quality audits by some of the world's largest AV companies and video wall manufacturers.

The dnp Total Quality Management system guarantees extremely high and uniform image quality – a feature, which is of utmost importance in video wall and multi-screen installations.

All dnp screens are designed and manufactured using advanced CAD/CAM systems. And the entire production process takes place in a clinically clean and controlled environment.

Every screen undergoes the strictest quality assurance checks before it leaves the factory: from evaluation of mechanical specifications (e.g. thickness and dimensions) and optical features (e.g. peak gain, brightness uniformity and viewing angles) to cosmetic appearance. When the screen has successfully passed all tests, it receives a product quality certificate.

Together with our local stock facilities, complete delivery package and reliant after sales support – this is your guarantee of a superior control room display product.

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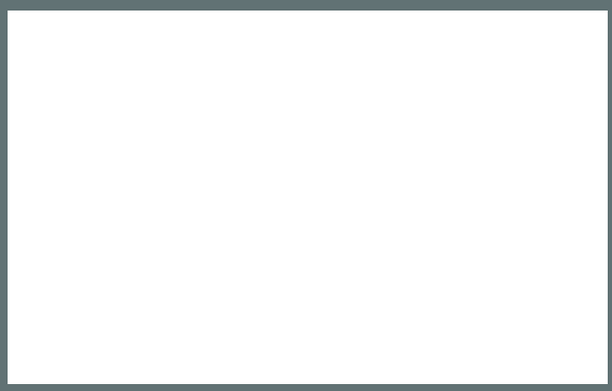
www.dnp.dk

dnp denmark as
Skruegangen 2
DK - 2690 Karlslunde
Denmark
Tel: +45 46 16 51 00
Fax: +45 46 16 52 00

Dai Nippon Printing Co. Ltd.
1-5-17 Higashi-sakashita
Itabashi-ku, Tokyo
174 0042 Japan
Tel: +81-3-5970-4661
Fax: +81-3-5970-4663

DNP Electronics America, LLC.
2391 Fenton Street
Chula Vista, CA 91914
USA
Tel:+1 619 397 6700
Fax:+1 619 397 6739



dnp denmark is the worldwide large screen centre of Dai Nippon Printing Co. Ltd – one of the world´s largest printing and media companies. The DNP Group has a total annual turnover of 13 billion US$.