STEP-BY-STEP GUIDE

How to select projector and screen for your meeting room

visual experience

Improve your image

Today, most presenters prefer a bright presentation environment so they can see their audience, and read their facial expressions and body language.

However, there is one big problem with room lighting: It can make even the best presentation look pale and boring if you choose a wrong projector-screen combination. This step-by-step guide will help you select the equipment needed to make perfect presentations in your meeting room:

- **Screen size and format**
- **Type of screen – plain white or optical screen**
- **Required projector brightness and lens**
- **Image sources/presentation software**

The guide is written by image-specialists from dnp denmark, a leading manufacturer of projection screens. The guide is an abstract from the more extensive dnp Technical Guide. All recommendations in the guide are based on requirements in typical conference rooms and the AV technology available at the time of writing. dnp denmark can not be held responsible for purchases based on the content of the guide.

If you have comments to this guide, or need more information, contact us at marketing@dnp.dk

Good luck with your presentation system!

Step#1

Basic needs and requirements for meeting rooms

Before you purchase AV equipment for your presentations, you need to know two things: What you want to show, and in which environment you are going to show it - room dimensions, ambient light level, viewing requirements (distances, angles) etc.

Presentation equipment

Typical presentation needs include PowerPoint, Word, Excel and internet, media player and maybe also a Vizualizer. Your shopping list could look like this:

> PC running 16:10 (I.E. WUXGA,1,920 x 1,200 pixel resolution)
> **M**edia player and Vizualizer running 16:9 (I.E. 1,920*1,080)
> A projector in 16:10 format*
> A projection screen in 16:10 format
> Control equipment to switch between image sources

Depending on lighting conditions in your meeting room and choice of screen type, you might also need to invest in room darkening/window blinds.

*Since the computer will be the most used equipment, we accept to have small black boarders on top and bottom of the image while displaying media player and Vizualizer, which are in 16:9 format. Alternatively we can use a scaler to transform media player and Vizualizer to 16:10 format.

Presentation environment

The typical conference room is a mid-size room between 20m² and 100m² (215-1100 ft2) with a moderate ceiling height and a rectangular shape.

In many situations there will be a window on one side of the room, which implies high ambient light levels.

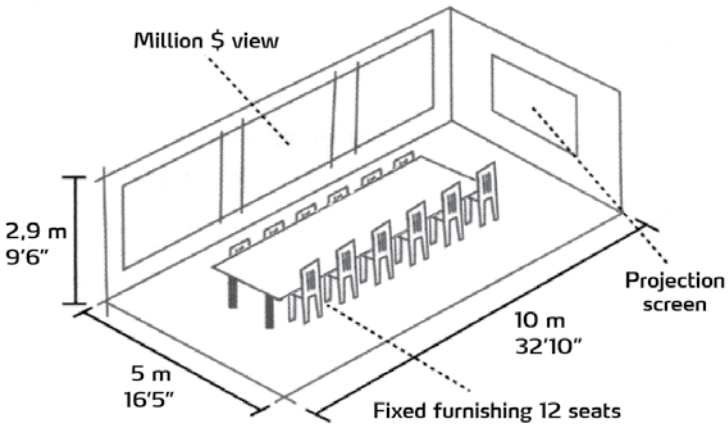

fig. 1 – typical conference room

Controlling the environment

Use drapes to control the daylight to a reasonable level. The windows closest to the screen should be completely blocked to avoid any reflections on the screen.

Using window drapes and the described lighting it is still realistic to have up to 450-500 Lux (42-47 ft-c) ambient light on the meeting room table and 200-250 Lux (19-23 ft-c) ambient light falling on the screen.

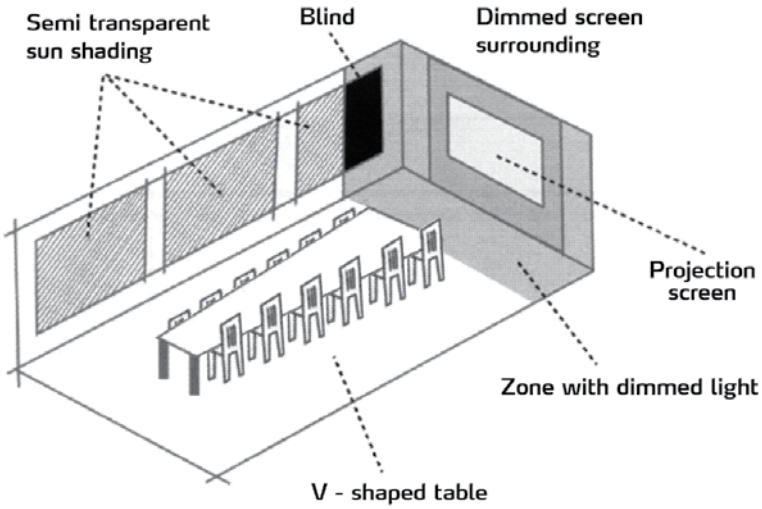

fig. 2- controlling light levels

Furthermore, the field of vision has to be optimized. Use muted colours on the wall surrounding the screen and avoid using light fittings with directly visible lamps. Illumination should be omni-directional and all luminances in the field of vision kept within a restricted contrast range.

The screen should be located centrally in the back wall following the centreline of the table and the height from the floor to the screen should be at least 90cm (35") to secure that everybody seated at the table can see the bottom of the screen.

Step#2

Calculating screen size, viewing distances and angles

Make a plan view drawing showing the room layout and seating arrangement in relation to the desired position of the screen.

Viewing distances

Take measurements from the centre of the screen to the minimum and maximum viewing distances, VDmax and VDmin.

As a general guideline, a viewing distance of 3 times the height of the image provides the best information from an image. The viewing distance should **not be less than 1.5 times the image height**, and the maximum viewing distance **not beyond 6 times the image height.**

Please note that this may vary depending on the resolution used.

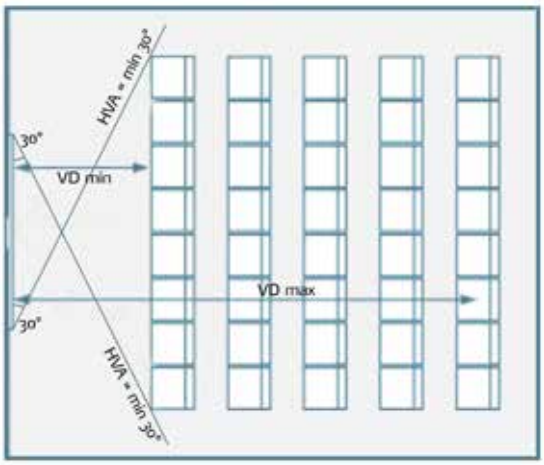

fig. 3 – viewing distance

Viewing angles

The ANSI/INFOCOMM V202.01:2016 standard recommends the horizontal viewing angle, HVA, to be minimum 30° from the farthest side of the image and the vertical viewing angle, VVA, to be within ±30° from the viewer (see illustrations).

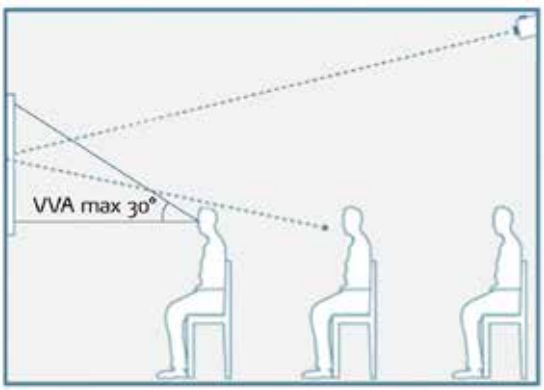

fig. 4 – viewing angles

Example:

Closest viewer is 2.74m (9ft or 108") from the screen. This gives a maximum image height of 2.74m/1.5 = **1.83m** (108"/1.5 = **72").**

Furthest viewer is 8.53m (28ft or 336") from the screen. This gives a minimum image height of 8.53m/6 = **1.42m** (336"/6 = **56")**

In this scenario we choose a 110" 16:10 screen which has an image area of (W * H) 2.369m * 1.481m = **3.51m2** (93.3" * 58.3" = **37.8 ft2)**

Step#3

Calculating required image brightness

Normally the light level in a meeting room is around 2-300 lux (19-28 ft-c) - or 4-500 lux (37-47 ft-c) if it is an open-office type of environment. As a rule of thumb the brightness level on the screen surface in such a room is typically 50% of the ambient light level on the table.

Use an Illuminance meter to measure the actual light level in the room. You can download a LuxMeter app for your smartphone or ask an AV reseller with professional equipment to do it for you.

The light level should be measured at the screen position and at the seating area, using the light settings and amount of daylight desired. These measurements will give an indication about the adaptation level and thus the requirements for the image brightness.

Required image brightness

As a rule of thumb, the **image peak luminance** should be **2-3 times the luminance of a sheet of white paper on the table** in order to be comfortable to look at. If the illumination level at the table position is, say, **400 lux** (37 ft-c), then the luminance from a pure white surface will be 127 nit (400/ϖ) (37 ft-L) and the target image brightness should be **254-381 nit (74-111 ft-L).**

Remember that in a room with more light on the conference table, the required screen brightness will be higher in order to create a good viewing experience on the screen.

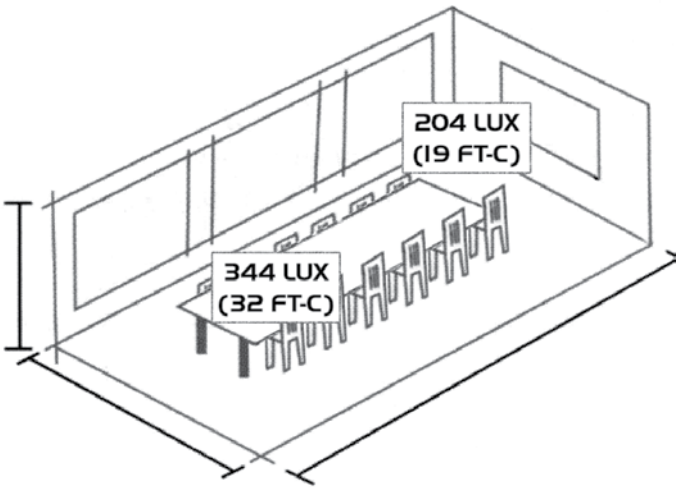

fig. 5 - in-room light levels

Example

The meeting room is very bright with **344 lux** (32 ft-c) ambient light on the table. The light level at the screen position is measured to 204 lux (19 ft-c) = 59% of the light on the table.

The luminance of a white paper on the table is 344/ϖ = 109 nit (32 ft-L).

This gives a required image brightness of **218-327 nit (64-96 ft-L).**

Step#4

Deciding on required image contrast

According to the global ANSI/InfoComm 3M-2011 standard, Projected Image System Contrast Ratio, AV applications for meeting rooms should have an image contrast ratio of minimum 15:1 in order to deliver "acceptable" quality.

A system image contrast ratio of **20:1 is perceived as "good" quality.**

We recommend aiming for 20:1 in system contrast ratio.

fig. 6 – The central screen in this conference room is a dnp Supernova Infinity. The screens to the left and right are standard white screens. Note the big difference in brightness and contrast.

Step#5

Selecting the right screen

Once you have calculated required image brightness and decided on minimum contrast needed to produce a good high-contrast image, you should consider which screen to use.

Although it only represents a small part of the total AV budget, the screen is inarguably the face of the display system. A good screen can dramatically enhance the image quality. A cheaper one can ruin your image – which makes it a false economy in the long run.

There are two types of projection screens on the market: conventional **diffusion screens** and **optical screens.** In the diffusion screen category white screens are dominant. Conventional "white" diffusion screens are essentially white surfaces, which reflect projected light and ambient light and send it back in all directions. Such screens are generally said to have a Gain of 1.

These screens are relatively cheap but typically require a dark presentation environment – often requiring additional investments in window blinds and/or a more powerful projector than you would need with an optical screen. Optical screens such as the dnp Supernova Screens have a built-in lens system, which enables you to control the projected image for maximum impact and enhance the contrast level of a projected image by up to 7 times. As a result these screens require a smaller and less expensive projector, as you will see in next section.

Optical screens are more expensive but work excellent in high ambient light where traditional projection screens do not perform well. The reason is that dnp Supernova Screens do not reflect as much unwanted ambient light ("noise") as other screens because ambient light is absorbed within the lens system.
The ambient light reflectance of a white screen is typically 20-30%. The ambient light reflectance of a dnp Supernova Screen is normally around 5-6% .

Ask the manufacturer for the actual figure of the specific screen (or look for it on the data sheet).
As you will see in next section, the screen's ambient light reflectance has huge impact on how much projector brightness is needed to deliver a good quality image. In the dnp Supernova Screen optical screen category, you can choose from different designs and visual properties.

Basically there are two types of Supernova Screen materials:

1. Low-Gain type offering good uniformity and wide viewing angles
   (on-axis Peak-Gain of 0.8; Horizontal Half-Gain angle of 85°)

2. High-Gain type offering high brightness and narrow viewing angles
   (on-axis Peak-Gain of 2.3; Horizontal Half-Gain angle of 23°)

[1] Depending of screen material and light setup – consult your AV reseller or see step 7

Choice of screen material depends on how the audience is seated in the room and type of screen.

In rooms with a long conference table in front of a fixed screen we recommend High-Gain screen material.

In rooms with wide seating arrangements and a retractable or portable screen, you should go for Low-Gain screen material.

This table gives you an overview of which screen types are available in the dnp Supernova Screen series.

	Optical front screens / dnp Supernova Screens						
	dnp Supernova Infinity	dnp Supernova One/Blade/Core	dnp Supernova Flex Classic	dnp Supernova XL	dnp Supernova STS	dnp Supernova STW	dnp LaserPanel
Frame design							
Size in inches	Infinite size	Up to 120"	Up to 120"	Up to 240"	Up to 100"	Up to 120"	100"

fig. 7 - dnp Supernova Screen models

fig. 8 - dnp Supernova Screen in bright meeting room.

Step#6

Selecting projector and lens

Based on the image requirements and ambient light conditions, you can now calculate the required brightness of the projector (measured in Lumens).

The required (effective) projector brightness is determined by 8 factors:

1. Ambient light in the room (here = 344 lux = 32 ft-c)
2. Ambient light on the screen (here = 204 lux = 19 ft-c)
3. Reflectance factor of the specific screen (Supernova = 6%, Standard white = 25%)
4. Required projected image system contrast ratio (here = 20:1)
5. 4x4 checkerboard contrast ratio of the projector itself (here estimated = 80:1, but look in product specs) [1]
6. Required image brightness of display (here = 218-327 nit = 64-96 ft-L)
7. Screen area (here = 3.51m2 = 37.8 ft2)
8. Screen Gain (2.3 for Supernova High-Gain, 0.8 for Supernova Low-Gain, 1 for standard white screen)

6.1 Verify calculated image brightness

Make sure that the calculated minimum image brightness, in order to meet the requested image contrast level, is within the required image brightness range (see step 3).

Minimum image brightness needed to obtain the 20:1 contrast ration is calculated like this:

AMBIENT LIGHT ON SCREEN * SCREEN REFLECTANCE * PROJECTOR CONTRAST * (IMAGE CONTRAST – 1) / (PROJECTOR CONTRAST – IMAGE CONTRAST)

In our example: 204 * 0.06 * 80 * (20-1)/(80-20) = **310 nit.**

This value is acceptable as it is within the required image brightness range of 218-327 NIT. If the value was outside the “tolerance” you would need to adjust image contrast ratio or light level until specifications are met.

The formula is slightly different for US units:
AMBIENT LIGHT ON SCREEN * SCREEN REFLECTANCE * PROJECTOR CONTRAST * (IMAGE CONTRAST – 1) / (PROJECTOR CONTRAST – IMAGE CONTRAST) * PI

In our example: 19 * 0.06 * 80 * (20-1) / (80-20) * 3.14 = **90.5 ft-L**

This value is acceptable as it is within the required image brightness range of 64-96 ft-L.

[1] Note! This is the ANSI checkerboard contrast, which will typically be in the range between 60:1 and 100:1. This value is not always found in the projector datasheets. Ask the manufacturer for the value or use an estimated contrast level of 80:1.

6.2 Calculate required effective projector brightness

Now calculate how much effective projector brightness you need to reach above brightness level (the effective light output from a projector may vary significantly from specifications).

PROJECTOR BRIGHTNESS = IMAGE BRIGHTNESS * IMAGE AREA * PI / SCREEN GAIN

In our example: 310 * 3.51 * 3.14 / 2.3 = **1,487 lumens**

The formula is slightly different for US units:

PROJECTOR BRIGNTNESS = IMAGE BRIGHTNESS * IMAGE AREA / SCREEN GAIN

In our example: 90.5 * 37.8 / 2.3 = **1,487 lumens**

6.3 Compare screen solutions

You are now able to compare different solutions by replacing the parameters of different screen types/materials (the grey fields in the table below) in the calculations.

As you can see in the comparison table, the results are very different:

	Supernova 23-23 material	Supernova 08-85 material	White screen	
Ambient light in room	344 lux / 32 ft-c			
Ambient light on screen	204 lux / 19 ft-c			
Screen reflectance	**0.06**	**0.06**	**0.25**	
Required image contrast	20:1			
Estimated projector contrast	80:1			
Required image brightness	218-327 nit / 64-96 ft-L			
Screen area	3.51 m2 / 37.8 ft2			
Screen Gain	**2.3**	**0.8**	**1.0**	
Real image contrast	20:1	20:1	20:1	6.6:1
Real image brightness	310 nit 90.5 ft-L	310 nit 90.5 ft-L	1,292 nit 377 ft-L	311 nit 90.8 ft-L
Required projector brightness	1,487 lumens	4,275 lumens	14,253 lumens	3,431 lumens
Projector brightness adjusted for calibration loss (10%)	1,652 lumens	4,750 lumens	15,837 lumens	3,812 lumens
Projector brightness adjusted for lamp decay (25%)	2,203 lumens	6,333 lumens	21,116 lumens	5,083 lumens

The numbers in red colour mean that the required specifications are not met: 6.6:1 contrast is way below the recommended 20:1 level and 1,292 nit is far too bright to create a comfortable viewing experience.

The required brightness and contrast changes depending on screen type. Typically a white screen in a meeting room needs to be 4 times as bright in order to deliver the same image quality.

You now have an idea of how much projector brightness you need for your system.

Due to brightness loss in the projector (caused by calibration and lamp decay) there is often a significant difference between what a projector is specified to output and what the actual light output is.
The last two rows compensates for 10% brightness loss due to calibration, and 25% brightness loss due to gradual lamp decay in the service life of the lamp.

As a general rule of thumb the specified lumens of the projector should be 1.5 times the required lumens (i.e. if you need 3000 lumens, look for a 4500 lumens projector).

6.4 Projector placement

Due to the lens structure in Supernova optical screens the projector should not be placed at too steep an angle. The incident angle of light should not exceed 25 degrees, where 0 degrees is perpendicular to the screen.

To position the projector correctly you can use the following formulas:
If projection distance is known (x) => Maximum vertical offset is 4/10 * x
If vertical offset is known (y) => Minimum projection distance is 24/10 * y

x = the horisontal distance from projector lens to screen front (min. 2x the image height).
y = the vertical distance from the bottom of the image to the projector lens (with projector above screen). If the projector is below the center, the distance is from the top of the image to the projector lens.

Examples:
If the projection distance is 3.35m (132") the maximum vertical distance is
4/10 * 3.35m (132") = 1.34m (52.8").

If the vertical offset is 1.52m (60") the minimum projection distance is
24/10 * 1.52m (60") = 3.66m (144")

For Supernova 23-23 screen material we recommend to add 20% to above projection distance in order to reduce hot-spotting (min. 2.4x the image height).

Example:
The min. projection distance for Supernova 23-23 screen material is 3.66m (144") * 1.2 = 4.39m (172.8")

Step#7

Sourcing products and assistance

fig. 9 - dnp Supernova Screens are designed to absorb
ambient light so they can be used even situations with large amounts of natural light.

You now have a pretty good idea of what type of equipment you need to buy in order to make a great presentation:

> Screen size and format
> Type of screen – plain white or optical screen
> Projector brightness

If you need help with the calculations we recommend that you talk to a professional AV installer with experience in presentation solutions for meeting and conference rooms.

All certified dnp resellers are trained in these calculation and can help you find a proper solution for your meeting room.

Get a free proposal here