

Optical vs. Diffusion Screens

The screen is the face of the rear projection system. It is the natural centre of attention. Therefore, the choice of screen has huge impact on how viewers perceive the quality of the total display solution.

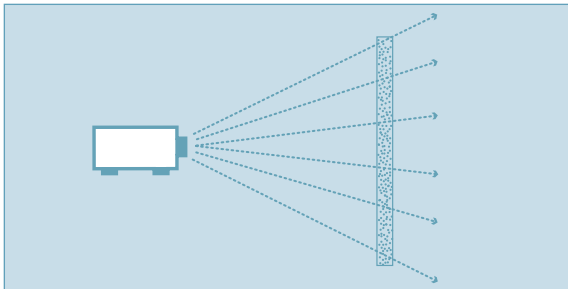
There are two different categories of rear projection screens on the market: optical (Fresnel) screens and diffusion screens.

It is well known that diffusion screens are less expensive than optical screens. So why is it then, that manufacturers of commercial retro displays, cubes and rear projection TVs, who work in fiercely competitive markets, don't use diffusion screens?

Among OEMs it is recognized that optical screens are essential to provide the image quality levels that consumers and presenters require. Moreover, optical screens offer good price-value as they use light more effectively and allow the installer to use less expensive projectors.

To understand this, we have to look at the fundamental differences between the two screen types:

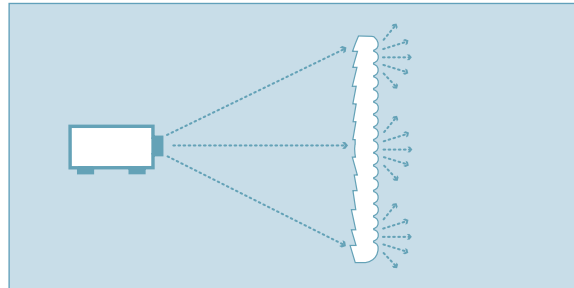
What is a diffusion screen?



As diffusion screens are unable to focus light, a large proportion of the light is transmitted away from the viewing area. This "waste" of light results in lower screen brightness (gain).

A diffusion screen is essentially an acrylic sheet tinted or coated with a diffusion agent. The diffusion particles on the surface or inside the screen material "stop" the light and generate the image on the screen. As diffusion screens do not have an optical lens structure, they are not able to control the light from the projector and distribute it evenly through to the screen viewer. Consequently, the intensity of the light is stronger at the screen centre, and weaker towards the corners. This uneven distribution of light is often referred to as the "hot-spot". Another disadvantage of diffusion screens is the relatively poor viewing angles.

What is an Optical Screen?



The Fresnel lens focuses the light from the projector and sends it straight forward towards the viewers. As a result, optical screens provide two to four times brighter image than diffusion screens.

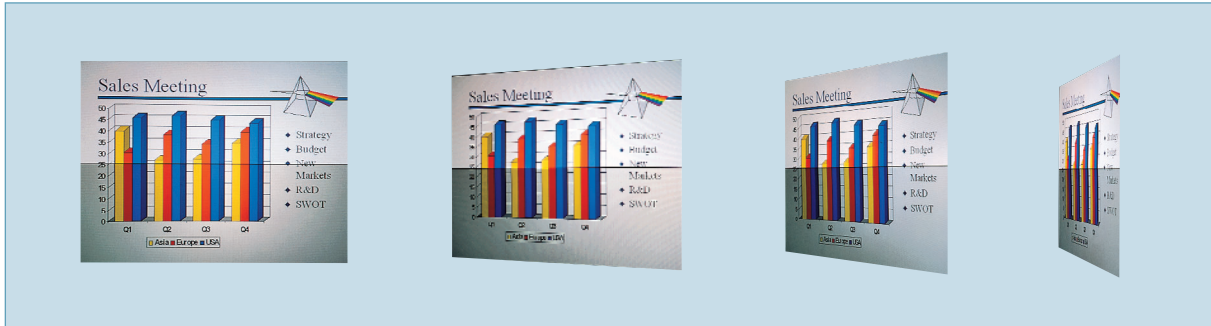
The core element in all optical screens is the Fresnel lens. The Fresnel is made up from thousands of concentric lenses – each with its own unique profile. Barely visible to the naked eye, these lenses form a circular pattern from the screen centre and outwards – like ripples in a pond. The combined effect is to focus the light from the projector and redirect it in a straight line towards the viewer. The Fresnel lens is often combined with a linear lenticular lens system, which redistributes the light and creates pre-specified viewing angles. These viewing angles can be optimized for different applications depending on where the viewers are seated or standing relative to the screen.

Optical or non-optical?



Split screen comparison

This split-screen comparison between an optical screen (upper half) and a diffusion screen (lower half) demonstrates the "hot spot" in the screen centre that is typical for diffusion screens.



Split screens at different angles

Optical screens (upper half) are markedly brighter than diffusion screens due to their ability to focus light and distribute it in a straight line towards the viewer. Note the characteristic hot spot, the dark corners and the low brightness of the diffusion screen.

Most professional OEMs and AV installers prefer to use optical screens in their rear projection solutions. And there are two basic reasons why: The first is the evenness of image brightness – avoiding the infamous “hot spot”. The second reason is image brightness itself.

The uniformity issue – avoiding hot spot

The screen’s ability to produce uniform images is essential in most applications – especially if the display is made up from several screens. Even small differences from corner to centre and between neighbouring screens can irritate the eye.

The basic problem with diffusion screens is the “hot spot”, which is very visible in the centre of the image. The problem is caused by the diffusion screen’s inability to redirect the light. As a result the light from the projector is angled away from the viewer in the corners. The problem of a “hot spot” in the centre and dark corners is worse with wide-angle projector lenses (e.g. less than 1.8:1 projection ratio) and often extreme with the lenses used most commonly in rear projection applications (0.8:1 – 1.2:1). This makes it almost impossible to use diffusion screens in applications, which require a short built-in depth.

The brightness issue

On average optical Fresnel screens produce two to four times higher image brightness (gain) than diffusion screens. This feature is particularly important in projection environments with high levels of ambient light. The optical screens’ high brightness is often combined with contrast enhancing technologies that helps the installer to deal with critical issues such as ambient light, reflections and difficult viewing angles.

Users of diffusion screens may object that projectors have become much brighter. That is true, but customer expectations have increased as well. Today, companies want bright

and ergonomically friendly conference rooms without curtains and window blinds. There is also a growing market for commercial displays in brightly lit environments such as shops and window displays. And in high-light situations like these, optical screens have great advantages to diffusion screens.

When are diffusion screens an option?

In general the image quality of optical screens is superior to that of diffusion screens. However, there are situations where diffusion screens may be an acceptable – or the only – solution:

- low-price/low-critical installations

Diffusion screens are cheaper than optical screens. They also provide poorer images. However, if price is more important than image quality – and if you have space for a projector throw of 1.8:1 or more – they can be a useful alternative. E.g. in low-critical meeting rooms or Point of Sale displays with controlled light levels.

How to specify the correct screen

The choice between optical screens or diffusion screens is not the only choice the AV installer has to make.

Within each of these groups there are a number of different screen types. Some screens are designed for conference rooms, others for control rooms or Point of Sale applications.

If you need help to specify the best possible screen for an installation job, feel free to consult your local dnp distributor or dealer. They have years of rear projection experience and will be glad to help.

For more information or nearest dnp partner, please visit www.dnp.dk.

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What is rear projection?

Rear projection means that the projector is placed behind the screen, shooting straight forward towards the audience. The presenter can stand in front of the image without being blinded by the projector or casting unprofessional shadows onto the presentation. And with the technical equipment hidden behind the screen, the conference room remains quiet, clean and tidy.

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Screens of the art