

# Briefing note – control room screen arrangements

## 1 Introduction

It is rarely possible to arrange every screen in a control room in a way that satisfies every requirement. The aim should be to select an optimum that minimises the main risks.

### 1.1 Risks to be managed

The following risks should be actively considered when arranging screens:

- Events requiring attention being missed because a screen is not in the operator's line of vision or information is illegible (e.g. too small)
- Errors made because data on the screen is misread or misinterpreted (e.g. distorted due to the angle of vision)
- Musculoskeletal harm due to poor posture while viewing the screen
- Visual fatigue due to changing viewing distances or high light levels.

### 1.2 Screen uses

Screens in control rooms will usually fall into one of the following three types:

- Work – normal sized screen used actively to input data, make selections
- Monitoring – normal sized screen used primarily for observing data, trends etc.
- Shared view – large screen that displays overviews that may be of interest for other people (i.e. not the control room operator) or referred to during team discussions.

In this context a 22" or 24" screen is considered normal. Any screen over 40" is large. In all cases the screens are assumed to be flat with a ratio of 16:9. The information in this note does not apply to ultra-wide or curved monitors.

## 2 General guidelines

There are few defined rules, but the following summarise guidelines to be considered when reviewing screen arrangements.

### 2.1 Human visual field

Human eyes can take in information from a very wide angle but when viewing screens, central rather than peripheral vision, is used. 15° from the centre of vision, horizontally and vertically provides the most detailed information to the brain. 30° is the outer limit of central vision, and people will move their head to relocate the centre of vision to observe something in this region.



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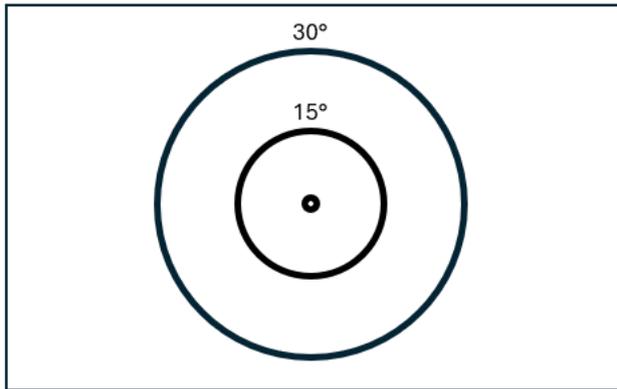


Figure 1 – Visual field

### 2.2 Optimal screen position for work

Standard display screen equipment (DSE) guidance applies for work screens (as defined above). This states that the top of the screen should be at eye level and at approximately arms-length.

#### Using DSE Safely



While seated ensure the following:

- ① Your back is straight and the lower back is supported by the backrest.
- ② Your thighs are parallel to the floor in a slightly downward position.
- ③ Your feet are resting comfortably on the floor (if not possible, a footrest may be required).
- ④ Your forearms and wrists are in a straight line while typing, your shoulders are relaxed.
- ⑤ Eyes are level with top of screen or slightly below eye level.
- ⑥ The screen is approximately at arm's length and is positioned to avoid reflective glare.
- ⑦ Keyboard is directly in front of you with enough space to rest forearms on the desk between keyboard and desk edge.

Figure 2 - Image from

[https://assets.hse.ie/media/documents/CF\\_008\\_08\\_WE\\_Display\\_Screen\\_Equipment\\_Risk\\_Assessment\\_Worked\\_Example.pdf](https://assets.hse.ie/media/documents/CF_008_08_WE_Display_Screen_Equipment_Risk_Assessment_Worked_Example.pdf)



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## 2.3 Safe neck angle

The human head weighs approximately 5 kg, exerting significant strain on the neck when spinal alignment is compromised. Tilting the head forward up to 15° is generally considered safe due to the neck's natural range of motion. However, sustained upward extension beyond the vertical plane significantly increases the risk of musculoskeletal disorders.

Musculoskeletal disorders also occur when turning at the neck. Up to 30° left or right is acceptable for short duration, but should not be held for any length of time

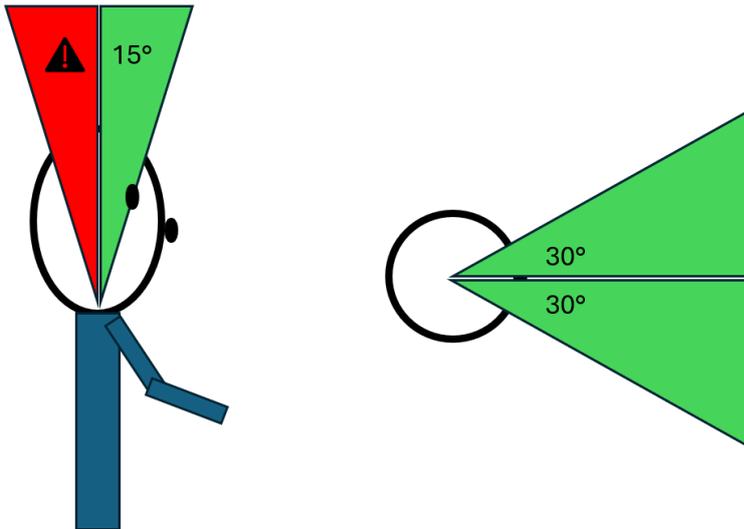


Figure 3 - Neck bending forward is generally OK but bending back is not. 30° left to right is acceptable

## 2.4 Causes of visual fatigue

Although it is rarely a long term concern, visual fatigue can be unpleasant and symptoms (e.g. sore or irritated eyes, trouble focusing, dry or watery eyes, blurred or double vision) affect the ability of people to work. Causes may include:

- Constant refocusing between near and far objects
- Exposure to high light levels
- High contrast between screen and background
- Squinting at small or low-quality text
- Screen flicker or pulsing lights.

## 2.5 Required text size

As a general guide, the limit of text legibility is 200 x the character height. This means a character 5mm on a screen can be viewed at up to 1 metre. If the viewing distance is doubled to 2 metres, the character height has to be 10 mm.



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### 3 Applying to control room screens

#### 3.1 Work screens

Ideally, an operator should be able to perform all work (e.g. start up or shutting down plant, changing process parameters or diagnosing the cause of an alarm) from a single normal screen located on the desk. If a second screen is required, it should be located immediately adjacent and at an angle so that viewing distance across both screens is similar and most of both screens will be visible within 30°.

Figure 4 illustrates this for two 24” screens (each approximately 500mm wide), being viewed from 700mm.

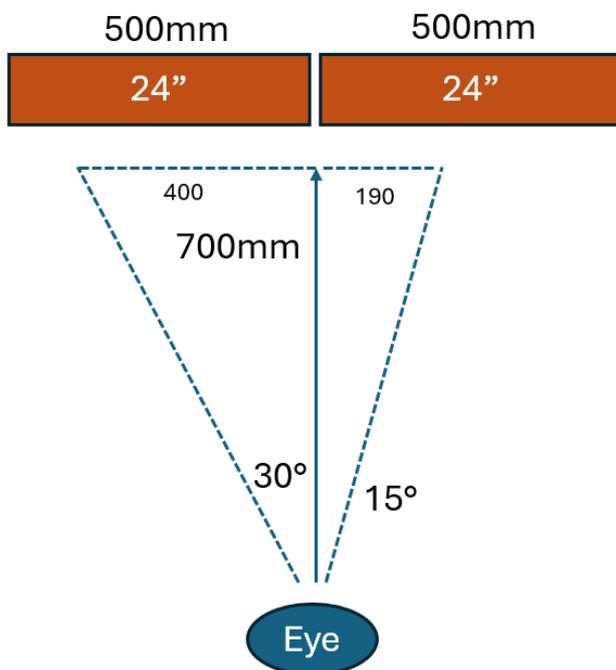


Figure 4 - Horizontal arrangement of two adjacent screens

Similar applies to use of an office computer, noting that control room operators are likely to spend a significant proportion of their time on non-process activities (e.g. reading emails, updating the shift log, reviewing procedures, attending Teams calls).

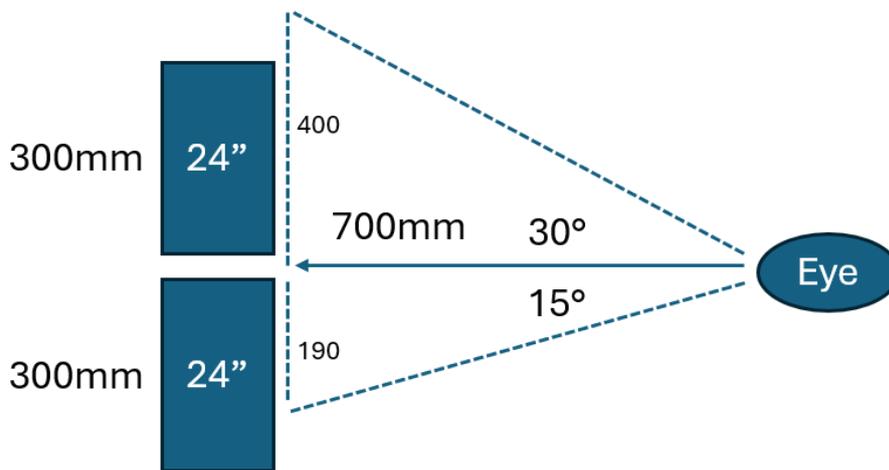
#### 3.2 Monitoring screens

Operators often have to perform work on one part of a plant while continuing to monitor other parts. They cannot use the work screens to do this, so have to be able to view other screens. Figure 4 above shows that the horizontal field of vision will already be taken up with the work activity. This suggests the only viable option is to use the horizontal field.

Figure 5 illustrates how two 24” screens, which would be approximately 300mm high, can be viewed from 700mm without exceeding the acceptable viewing angles. However, it is

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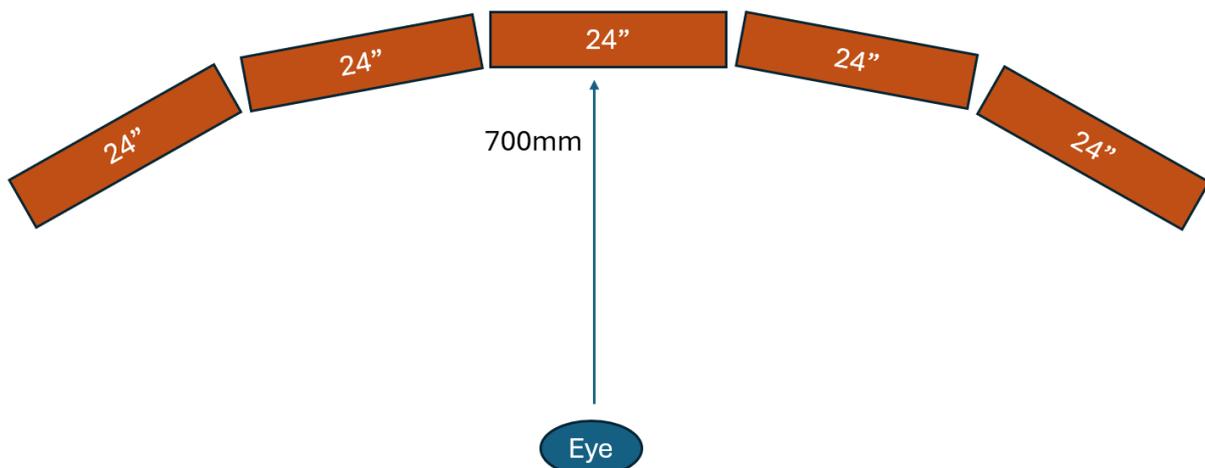
important that the lower screens are used for work and the upper for monitoring to ensure the operator's head is vertical or only slightly tilted down.



**Figure 5 – Vertical arrangement of two stacked screens**

At times when the operator is not performing work, the arrangement of monitoring screens becomes less important, especially if work screens can also be used for monitoring. However, as the number of monitoring screens is increased, the visibility and viewing distance become issues.

Ideally, viewing distance to each screen would remain constant from a central location so that the operator can scan them all from a central location without moving and without having to refocus on each. This is often impractical and an arc arrangement as shown in Figure 6 may be the best that can be achieved. Clearly, the number of screens arranged horizontally has a significant effect. Double stacking them helps because the horizontal distance between the first and last screen is halved. Large, shared view screens (see below) may be beneficial if configured correctly.



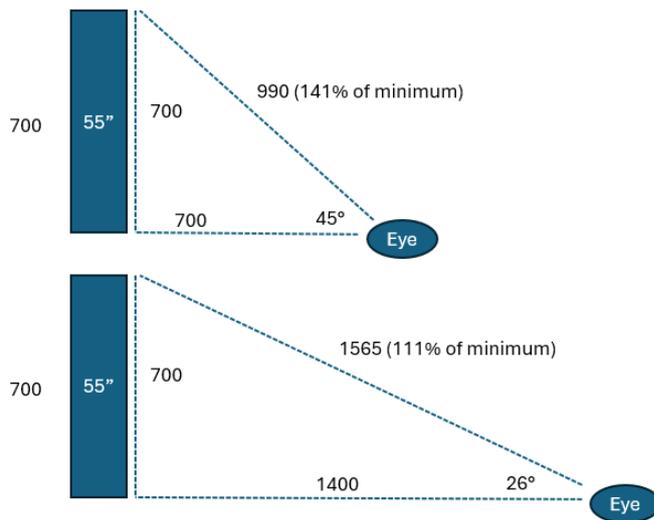
**Figure 6 - Challenge with arranging multiple monitoring screens**



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## 3.3 Shared view (large) screens

Large screens can create the greatest challenge with control room layout. They should be positioned further from the operator than working and monitoring screens. Figure 7 shows that extending the viewing distance from 700mm to 1,400mm for a 55” screen that is 700mm high reduces the viewing angle from 45° to 26°. Also, the difference in viewing distance between top and bottom of screen is reduced from 141% to 111% compared to the minimum distance.



Also, large screens emit a lot of light that can contribute to visual fatigue.

The size of text shown on shared screens has to be determined by the viewing distance. Ideally, graphical displays should be provided, that reduce reliance on text. For example, ‘Level 1’ displays, as defined in ISA-101 (and referred to in EEMUA 201 3<sup>rd</sup> edition), that use a range of graphical methods to display information including trends, analogue displays with target ranges and limits, and rotary dials.