

# RESOLUTION OR PIXEL DENSITY?



## Human eye resolution:

As we look at monitors with our eyes, it is important to first discuss the human “eye-limiting resolution”.

The widely admitted maximum resolution of the human eye is 60 pixels / degree.

If we express the human eye field of view in horizontal and vertical degrees, it means that an image of 60 x 60 pixels in 1 degree (3600 pixels total) will be not be perceived “sharper” than an image of 90 x 90 pixels (8100 pixels total) in the same 1 degree.

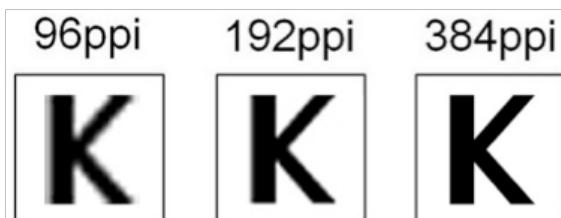
An Operator looking at 3600 pixels per degree resolution or at 8100 pixels per degree will not see the difference (except in price!).

Inversely if the same Operator looks at an image with 40 x 40 pixels / degree it will not appear to him as sharp as the image with 60 x 60 pixels / degree.

The 60 x 60 pixels per degree is the threshold resolution that should be used to decide when additional pixels are useful (visible).

## Display Resolution & Pixel Density:

**Display resolution** is expressed in number of pixels horizontally and vertically, regardless of the screen size. A pixel is constituted of 3 dots (R, G, B). Some manufacturers publish the number of dots instead of pixels. Divide the number of dots by 3 to obtain the number of pixels.



**The density** is the resolution within a specific surface area. For example a display that has a resolution of 1280 x 720 (pixels) has a total of 921,600 pixels on its entire screen surface. If the display diagonal size is 10” the pixel per inch density (ppi) will be 146 ppi. If the display diagonal size is 7”, the density becomes 209 ppi.

A few feet away, the 7” display with a density of 209 ppi will look a lot sharper than the 10” to the human eye. Both displays have the same amount of information, but the smaller display packs the information (the pixels) closer to each other resulting in a crisper image. Pixel density calculators are readily available on the Internet.

## Viewing Distance & Pixel Density:

It is traditionally agreed that a person with perfect eyesight of 20/20 can read 720 ppi at a distance of 1 ft. Humans can see a maximum of 300 ppi (60% less) from a distance of 2.5 ft.

Beyond a distance of 3 to 4 feet from the display, the human eye cannot see the individual pixels. That is why a 24” television with a low pixel density from 6 feet away may look as good as a much higher pixel density 7” display viewed from 2 ft. Of course a 24” monitor looked at by the Director from 2 ft away needs a high pixel density to look sharp.

## What Else should be considered?

**The resolution is not relevant to a monitor sharpness until it is used to calculate its pixel density.**

The pixel density is only one of many parameters contributing to the image quality. It is the physical limitation of the “canvas” where the image is formed.

Other equally important parameters can make a monitor look sharp or soft even with the same pixel density: surface treatment of the display itself, addition of anti-reflective optical glass or bonded-glass (see our DISPLAY Technology section), pixels arrangements and pitch, processing technology and speed, backlight technology etc...

## Words of Wisdom:

Because so many other parameters than pixel density affect the image quality, we strongly recommend to look at monitors side by side before making a purchase. Reputable manufacturers will usually happily send you a demo to look at and **do your own comparison.**

## Choosing a monitor Size & Pixel Density:

First estimate how far you will place the monitor from you. A body-rig Operator may place the monitor as far as 3 ft away, while a Focus Puller may be only 1 ft away. You will find on the next page a chart to help select a monitor that works well with your viewing distance (all other parameters equal). A distance of 0 ft means that the monitor is not usable with the parameters entered.

<b>Monitor diagonal</b>	<b>Pixel Resolution</b>	<b>Pixels Per Inch</b>	<b>Maximum viewing distance</b>
5"	720x480	173	2 ft
	HD: 1280x720	293	1 ft
	FHD: 1920x1080	440	1 ft
	4K: 3840x2160	881	0 ft
	8K: 7680x4320	1762	0 ft
6"	720x480	144	2 ft
	HD: 1280x720	244	1 ft
	FHD: 1920x1080	367	1 ft
	4K: 3840x2160	682	0 ft
	8K: 7680x4320	1468	0 ft
7"	720x480	123	2 ft
	HD: 1280x720	209	1 ft
	FHD: 1920x1080	314	1 ft
	4K: 3840x2160	629	0 ft
	8K: 7680x4320	1258	0 ft
8"	720x480	108	2 ft
	HD: 1280x720	183	2 ft
	FHD: 1920x1080	275	1 ft
	4K: 3840x2160	511	0 ft
	8K: 7680x4320	1101	0 ft
10"	720x480	86	3 ft
	HD: 1280x720	146	2 ft
	FHD: 1920x1080	220	1 ft
	4K: 3840x2160	440	1 ft
	8K: 7680x4320	881	0 ft
12"	720x480	72	4 ft
	HD: 1280x720	122	2 ft
	FHD: 1920x1080	183	2 ft
	4K: 3840x2160	367	1 ft
	8K: 7680x4320	734	0 ft
15"	720x480	57	4 ft
	HD: 1280x720	97	3 ft
	FHD: 1920x1080	146	2 ft
	4K: 3840x2160	273	1 ft
	8K: 7680x4320	587	0 ft

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