

# Camera parameters

## Maximizing the image quality

The quality of an image is determined by many things: Illumination, lens and camera parameters. In the following text, we are going to take a look at how to set camera parameters for optimal image quality.

Please note:

- It is the responsibility of an on-site system engineer to establish the correct settings for illumination, lens and camera parameters in the context of real world applications.

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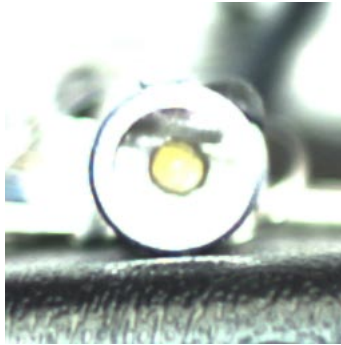
All weights and dimensions are approximate.

## Shutter (Exposure Time)

The shutter determines the CCD's exposure time. It may be adjusted manually or automatically (see [Auto Exposure and Exposure Reference](#)). The three first sample images show a key ring (the LED is initially off) with correct exposure time, one which is too short and another which is too long:



Correct exposure time



Exposure time too long

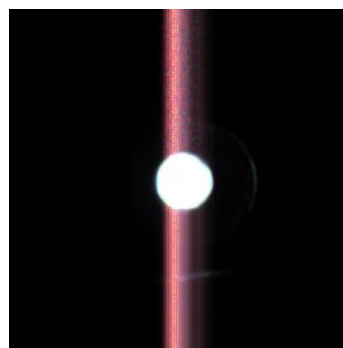


Exposure time too short

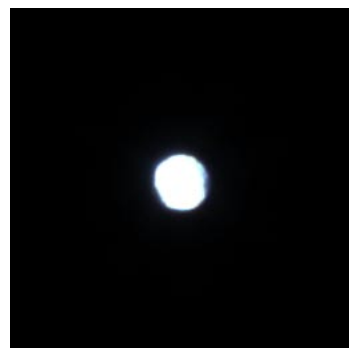
Switching on the LED, the image is overexposed in such a way that it only shows a big, white spot. The LED is correctly represented, if we decrease the exposure time. There is, however, a vertical line which disturbs the image. This is a typical CCD problem and is known as "smear". To avoid this, we close the diaphragm and increase the exposure time:



Extremely overexposed



Smear



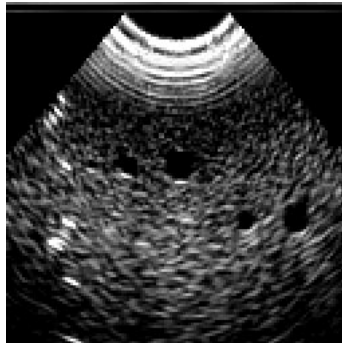
Correct representation

## Gain (Contrast)

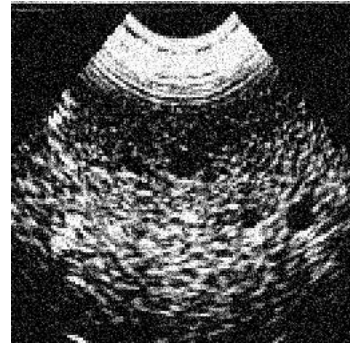
Gain determines the amplification of the CCD's output signal. This parameter may be adjusted manually or automatically (see [Auto Exposure and Exposure Reference](#)). The amplification increases the contrast. A high gain, however, leads to noisy images:



Source image



Contrast increase



Gain too high

## Offset (Brightness)

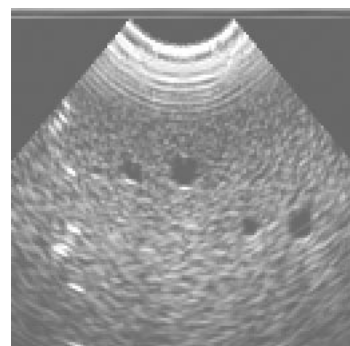
The offset is added to the CCD's output signal. This parameter may be adjusted manually or automatically. Therefore, adding the offset increases all graylevels. Thus, the image looks brighter:



Source image



Slight brightness increase



Overdone brightness increase

## Auto Exposure und Exposure Reference

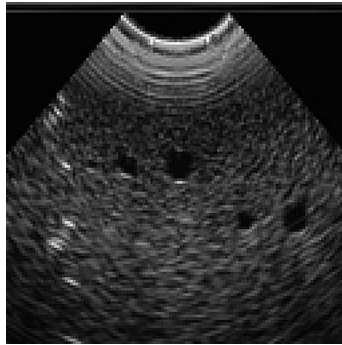
Auto Exposure determines whether the adjustment of the exposure time and the gain (see [Shutter](#) and [Gain](#)) is to be adjusted manually or automatically. You can use the parameter Exposure Reference to control the automatic operation. It compares the mean graylevel of the current image with the Exposure Reference. If these values are different, the exposure time as well as the gain are varied accordingly.

# Sharpness

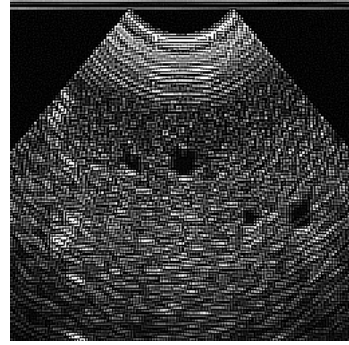
You may use this mechanism to enhance blurred images. Overdoing its application leads, however, to distortions:



Source image



Sharpness improvement



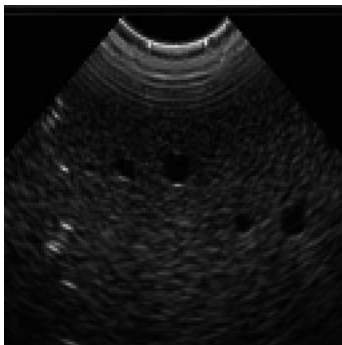
Overdone sharpness

# Gamma

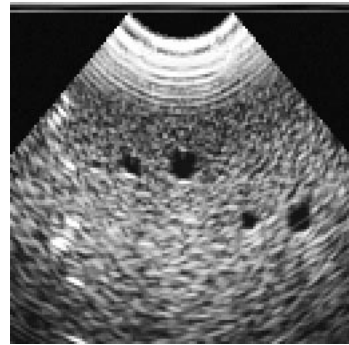
Gamma increases or decreases the middle graylevels. In other words, you compensate the non-linear behavior of picture tubes:



Source image



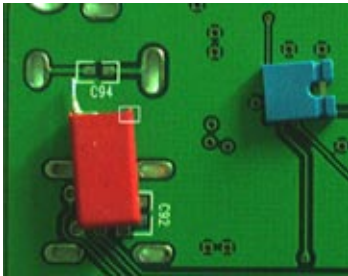
Increased middle graylevels



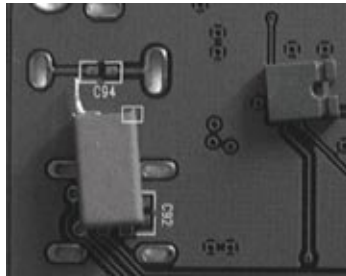
Decreased middle graylevels

# Saturation

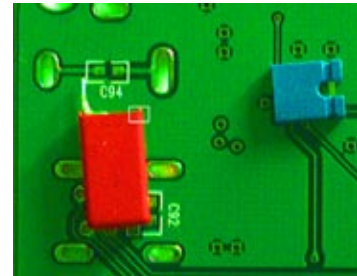
Use this parameter to adjust the color's saturation from monochrome to high color values:



Source image



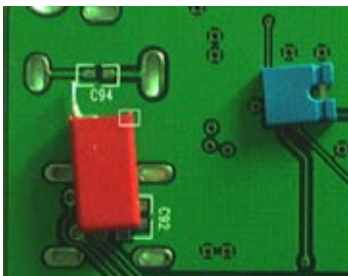
Saturation = 0



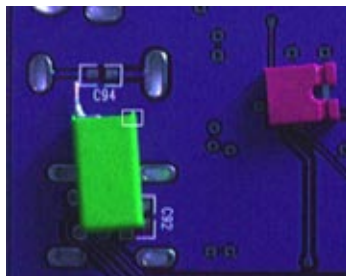
Maximum saturation

# Hue

Use this parameter to shift color values. Nevertheless, the relation between the colors remains (in contrast to the parameter [White Balance](#)):



Source image



Color shift

## White Balance

Use this parameter to vary the degree of red and blue in the image to achieve a lifelike color representation. The values can be controlled manually or automatically. The automatic white balance feature offers two operation modes:

**Auto:** the balancing algorithms affects the video stream continuously.

**One push** triggers only one pass of the adaptation procedure.

Simple multimedia cameras only provide one white balance parameter. Thus, increasing the degree of red leads to a decrease of blue and vice versa. High quality cameras offer two parameters and thus allow to adjust independently the degree of red and blue:



Source image



Degree of blue too low



Degree of red too low