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.

Content

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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
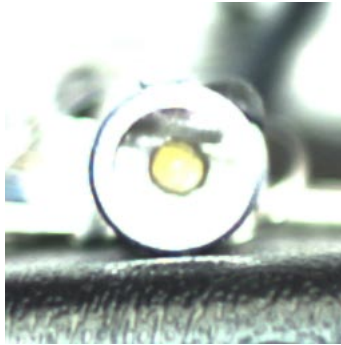
Exposure time too long

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:
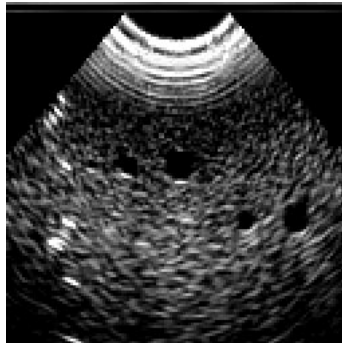

Extremely overexposed
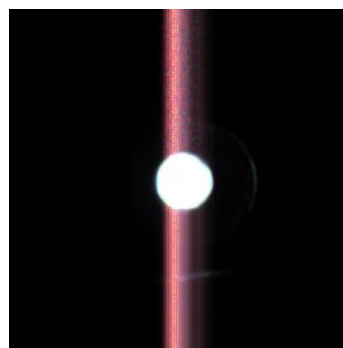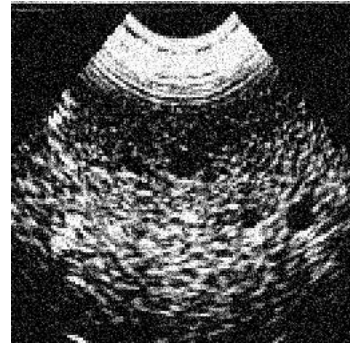

Smear
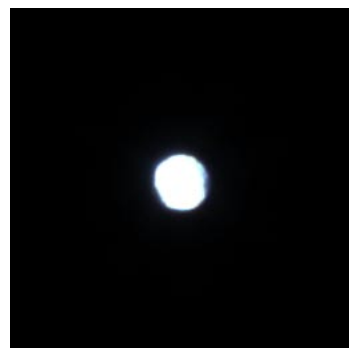
Correct representation

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

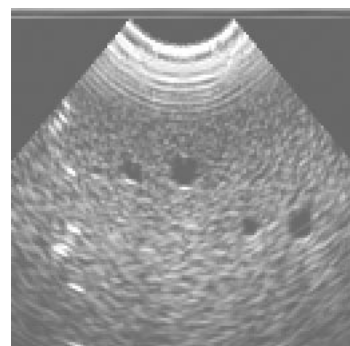Gain too high

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.
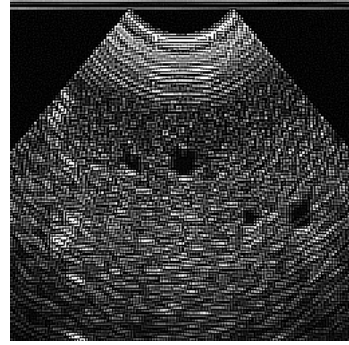
Sharpness

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

Source image
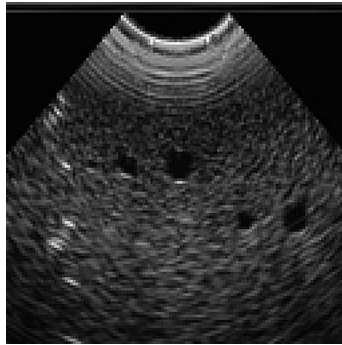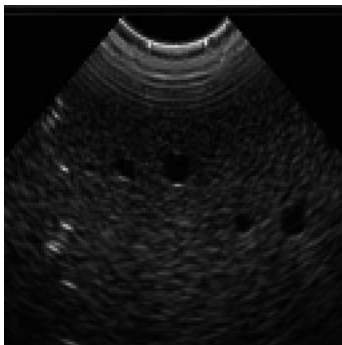

Sharpness improvement

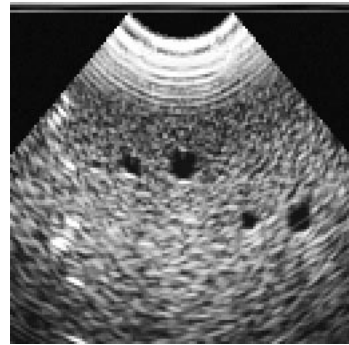Overdone sharpness

Gamma

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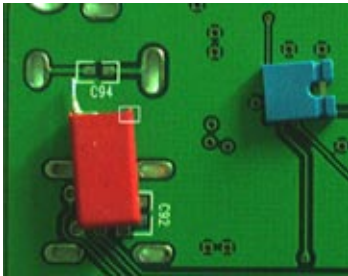

Source image
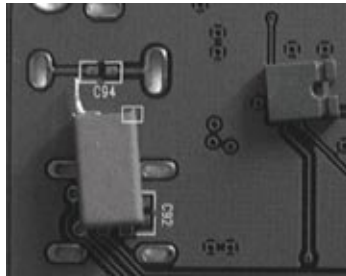

Increased middle graylevels

Decreased middle graylevels
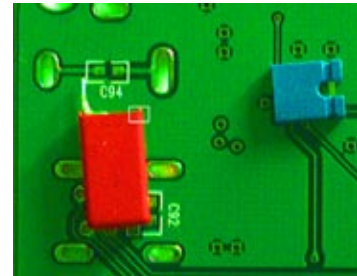
Saturation

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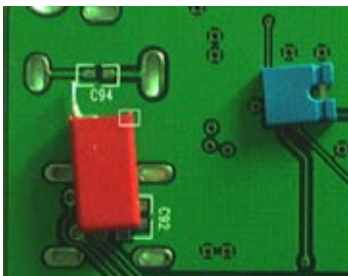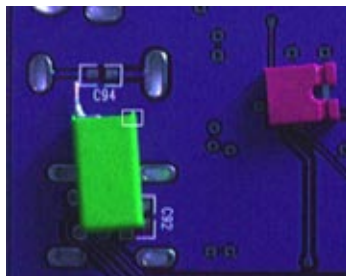

Source image

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