Baumer
Passion for Sensors

Application Note

VeriSens® – Motion blurring

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Description

In this document we will give answers to questions that are asked very often regarding motion blurring and how it can be avoided.

Products

VeriSens® Vision Sensors

Preparation

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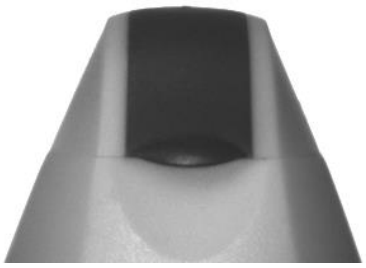
Contents

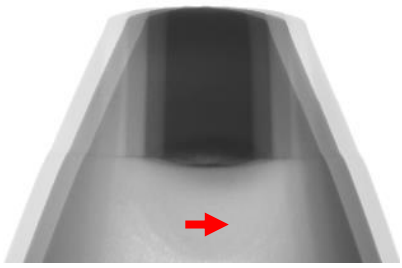
1 Motion blurring FAQs

1.1 When does motion blurring occur?

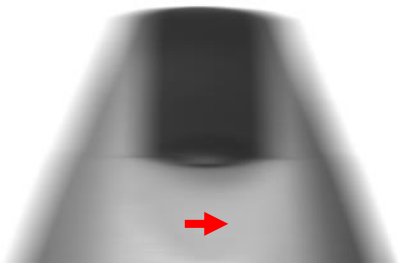
Motion blurring occurs, if the image is taken while the object is moving. The image sensor inside of the *VeriSens*® captures the scenery during the entire exposure time. If the object moves within that time, the movement becomes visible in the image. The single positions that were taken by the object during the exposure time overlay each other.



Object captured standing still



3 images overlayed with offset



Object captured in motion

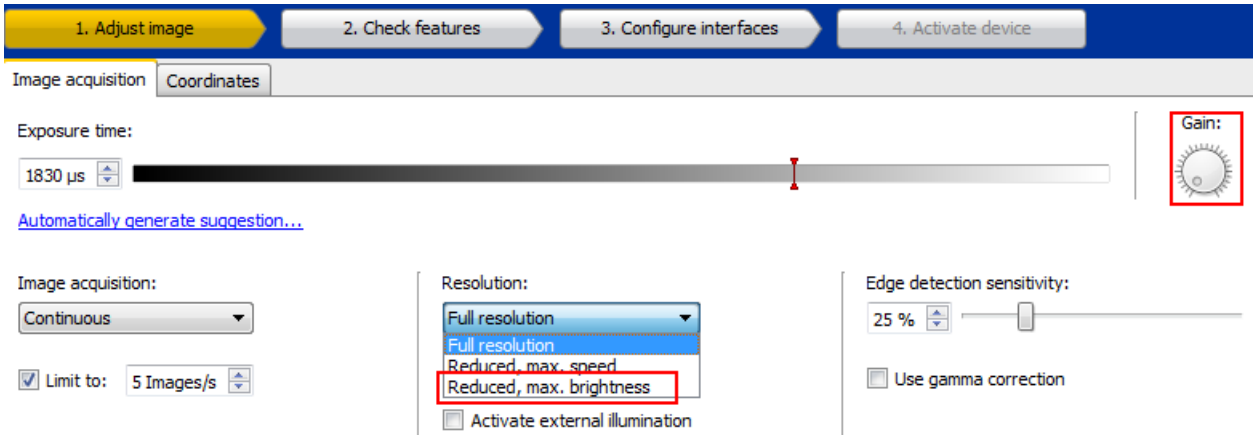
Motion blurring depends on two factors:
Speed of the object relative to the camera and **exposure time**.

1.2 What can I do to reduce motion blurring?

The object speed is normally given by the application. So motion blurring can only be reduced by setting a lower exposure time. In order to still get a bright enough image, further steps may be necessary:

Realizable with all *VeriSens*® series*:*

- Set higher "*Gain*". The brightness can be increased by a maximum factor of four. But a higher gain leads to higher image noise.
- Resolution "*Reduced, max. brightness*", binning mode for maximum brightness



- Increase **brightness of illumination**. You can do the following:
  - Put the illumination (or *VeriSens*® with integrated illumination) closer to the object.
  - Use a brighter illumination.

- Flash the illumination. (If you have a *VeriSens*® XC-series, you can use the integrated flash controller). Typically the brightness can be increased by the factor 2-3.

Realizable only with *VeriSens*® XC-series:

- Open the **aperture of the lens** wider. Each f-stop leads to a doubling of the image brightness. But the more you open the aperture, the lower the depth of sharpness becomes.
- Use a **more luminous lens** (Lenses with low focal width are normally more luminous than lenses with higher focal width.)

1.3 How can I calculate motion blurring?

The distance that the object travels during the illumination time (and the resulting motion blur) can be calculated as follows:

$$s = v \cdot t$$

The parameter v equals the conveyor speed and t the illumination time. At a illumination time of 1ms and a conveyor belt speed of $2^{m}/_{s}$ (=$2^{mm}/_{ms}$) the following motion blur results:

$$s = 2\,{}^{mm}/_{ms} \cdot\ 1ms = 2mm$$

This can be put to pixels, if the size of the image field is known. If the image field width is 60mm, and a VeriSens XF (resolution of image sensor: 752×480 pixels) is used, the motion blur is:

$$752px\ /\ 60mm\ =\ 12.5\,{}^{px}/_{mm}$$

So 2mm motion blurring equals ≈25 pixels in the image. Whether this can be accepted or not depends on the application.

1.4 How much motion blurring can be accepted?

It depends on the application, how much motion blurring can be tolerated. A universal calculation method does not exist.

The human eye can barely recognize a blurring of 1px in the image. But this can be too much for highly precise **measurement applications**. For **code reading applications** the motion blur has to be smaller than the half size of one module (width of the narrowest bar for barcode or width of the smallest block in a 2D-code). For **text reading applications**, it should not be more than half the thickness of a dot or line. For standard applications like **assembly and presence checks** the requirements strongly depend on the application. Depending on the kind of feature used, also big tolerances can be acceptable.
Nevertheless you should keep in mind that contours may not be found stably if the motion blurring is higher than 7px.

The given values are to be understood as a broad rule. Individual applications can have higher or lower requirements regarding motion blurring.

1.5 What illumination time do I need to get a sharp enough image?

If the acceptable tolerance of the motion blurring in an application is known (see abstract above), the maximum illumination time can be calculated.

Firstly it has to be known, how many pixels equal 1 mm (or another unit). This can easily be seen from the image field and the resolution of the *VeriSens*®. If the image field is 60 mm wide and a *VeriSens*® XF (image sensor resolution: 752×480 pixels) is used, the following resolution can be calculated:

$$60mm \,/\, 752px \approx\ 0.08\,{}^{mm}/_{px}$$

One pixel equals 0.08mm in reality.

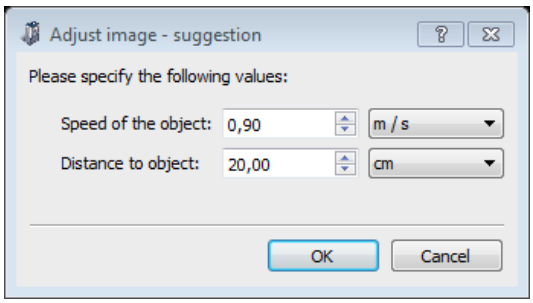
$$t = \frac{s}{v}$$

If the conveyor belt speed is $0.7\,{}^{m}/_{s}$ (=$0.7\,{}^{mm}/_{ms}$) and 3 pixels motion blurring can be tolerated, this is the maximum illumination time:

$$t = \frac{3px \cdot 0.08\,{}^{mm}/_{px}}{0.7\,{}^{mm}/_{ms}} = 343\mu s$$

So the illumination time should be 343µs at maximum. Of course shorter illumination times are possible any time.

For the *VeriSens*® models with integrated lens (XF, CS, ID), the Application Suite also provides a calculation tool that automatically calculates the fitting values is you enter speed and distance to object. For that, a accepted tolerance of 3 pixels has been assumed.



2 Support

In the case of any questions or for troubleshooting please contact our support team.

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3 Disclaimer

Baumer Group

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