

Scope

This document instructs on how to mask and manage pixel defects using the Allied Vision **Defect Mask Loader Tool**. The **Defect Mask Loader Tool** allows you to manage a user defined pixel defect list to match your application and optimize the life-cycle of the camera.

Tools for pixel correction overview

The **Defect Mask Loader Tool** supports Allied Vision GigE cameras with the **DefectMaskEnable** feature. Other cameras use different features and tools:

Family	Models	Tool	Application note download
Mako G	G-030, G-131, G-192, G-223, G-419, G-503	Defect Mask Loader Tool	This very document
Manta G	G-223, G-419, G-1620, G-2040, G-2460		
Prosilica GT	G12000, G12050, G14400, GT5400, GT6400		
Prosilica GT	GT1660, GT1910, GT1920, GT2300, GT2750, GT3300, GT3400, GT4905, GT4907, GT6600	Load Defect Tables Tool	www.alliedvision.com/fileadmin/content/documents/products/cameras/various/appnote/GigE/Load_Defect_Tables_Tool.pdf
Prosilica GT	GT4090, GT4096, GT5120	Defective Pixel List Management Tool	www.alliedvision.com/fileadmin/content/documents/products/cameras/various/appnote/GigE/Defective_Pixel_List_Management_Tool.pdf

Table 3: Tools for pixel correction overview

Why do pixel defects exist?

Defect pixels are inherent to all CMOS and CCD sensors, due to silicon impurities and manufacturing effects. Impurities in silicon wafers and sensor production processes make it very difficult to obtain defect-free CCD or CMOS sensors. Sensor manufacturers have different grades of sensors based on the number of pixel defects. Those with few to none are classified as higher-grade and are much more expensive. Some specific applications, such as flat panel inspection, might require these higher-grade sensors. Most machine vision applications, however, do not require a “perfect” sensor and the standard grade sensors are a much more cost-effective solution. The **Defect Mask Loader Tool** allows you to mask these pixels along with defect pixels which may be visible due to your specific application configuration.

Defects definition

A pixel defect has a response that deviates more than a specified value (threshold, deviation) from the local background in a dark image, corrected gray image, or a saturated image. As application requirements differ, it is not possible to find a common denominator to exactly define when a pixel is defective and when it is not. As consequence, sensor manufacturers define defects in various ways.

Almost all image sensors have a certain proportion of pixels that are defective and are commonly referred to as “bad” pixels or pixel defects. These pixels manifest due to defects in design of the semiconductor chip or manufacturing errors. They can also develop during operation of the sensors, particularly when the operating conditions are harsh and the sensors are operated for long periods of time.

Pixel defects can usually be divided into four main groups:

- Stuck high pixels are those which produce output values much higher than expected from its surrounding neighbors, even until the point of saturation of the value. Signal value is saturated or close to saturation and not influenced by light.
- Stuck low pixels are pixels whose values are much lower than expected from neighboring pixels and the value may even be completely low. Signal value is 0 or close to zero and not influenced by light.
- Hot pixels are pixels whose signal value is much higher than the neighbors and getting higher with exposure and temperature.
- Dark pixels are pixels whose signal value is much lower than the neighbors but not necessarily stuck low.

Dark current, that is a major contributor to pixel defects, is highly sensitive to temperature. Therefore, pixel defects and associated detection threshold levels are usually defined for a specific operating temperature.

For more information, please refer to the sensor data sheet or contact the sensor manufacturer. For sensor warranty information, see our [Sensor Warranty Terms](#).

Prerequisites for using the Defect Mask Loader Tool

The following items are required:

- Allied Vision GigE camera with **DefectMaskEnable** feature



You can enable or disable defect pixel masking in **Vimba Viewer**, under **Controls** >
`DefectMaskEnable = true/false`. By default `DefectMaskEnable` is `true`.

- **Vimba Viewer** installed on the host computer to adjust the camera exposure, gain, and pixel format. **Vimba Viewer** is part of the Vimba SDK API which can be downloaded from our website.
Download: www.alliedvision.com/en/products/software.html.
- **Defect Mask Loader Tool** to mask the defects.
Download from www.alliedvision.com/en/products/software/defect-mask-loader.html.



This tool is for use with Microsoft Windows only.

- Third-party tool image processing program as **ImageJ** to inspect the image and identify pixel defects in an image.
Download from rsbweb.nih.gov/ij/download.html.

Performing pixel defect masking

Detecting pixel defects



We advise using a homogeneous scene to detect pixel defects. It may be harder to detect pixel defects in a usual scene versus a homogeneous bright or dark scene.

1. Connect your Allied Vision GigE camera to the host computer and power, and start **Vimba Viewer**. Wait until the camera is listed in the **Detected Cameras** list. This may take a few seconds.
2. Click on the camera serial number and open the **Features** window by selecting the **All** tab.
3. In **Controls** > **DefectMask**, set **DefectMaskEnable** to *false* to disable the feature.
4. In **Controls** > **Exposure**, increase **ExposureTimeAbs** to a value suitable for your application or until pixel defects are visible.



Increasing exposure time will increase the number of hot pixels; however, these may not be considered as pixel defects by the sensor manufacturer. Check the sensor data sheet to see if there is constraint on exposure value in defect pixel definition.

5. In **Controls** > **GainControl**, increase **Gain** to a value suitable for your application. We recommend setting **Gain** to 0 as **Gain** can cause pixels to appear noisy.

For bright image acquisition, use an EMVA1288 compliant optical setup providing uniform illumination of the sensor with white light (CCT = 5000 to 6500 Kelvin). For bright image acquisition, the video signal level should be in the 60 to 70 percent range (or full scale).

For dark image acquisition you can leave the lens cap attached.

6. Click the **Freerun** button to initiate live camera view. Right-click on the image and uncheck **Color Interpolation**. Right-click on the image and save the image to the host computer as a TIFF file.

Let the camera run for 30 minutes to allow the camera temperature to normalize before saving an image. Ambient temperature should be in the 20 to 25 degrees Celsius range.

We recommend saving both a dark image and a bright image. A dark image will allow you to detect hot pixels. A bright image will allow you to detect dead pixels.



RAW and monochrome pixel formats are better for defect pixel detection.

7. Open the saved TIFF files in **ImageJ** or a similar application. Locate the exact coordinates of pixel defects using the application tools.



You can also select the defect pixels by using **Threshold** functionality in **Image/Adjust** menu in **ImageJ**.

Masking pixel defects

This part uses the **Defect Mask Loader Tool**.

1. With **Vimba Viewer** closed, run DefectMaskLoader.exe.
2. Connect a supported camera to the host computer. After the camera is detected, the camera DeviceID will be displayed next to **Status**.



Ensure that only one camera is connected. If multiple cameras are connected, only the first detected camera will be opened.

3. Enter the pixel defect coordinates, one per line and click **Overwrite**.

To append to an existing defect table:

- Click **Read** to view the current pixel defect list.
- Add new entries
- Click **Overwrite**.

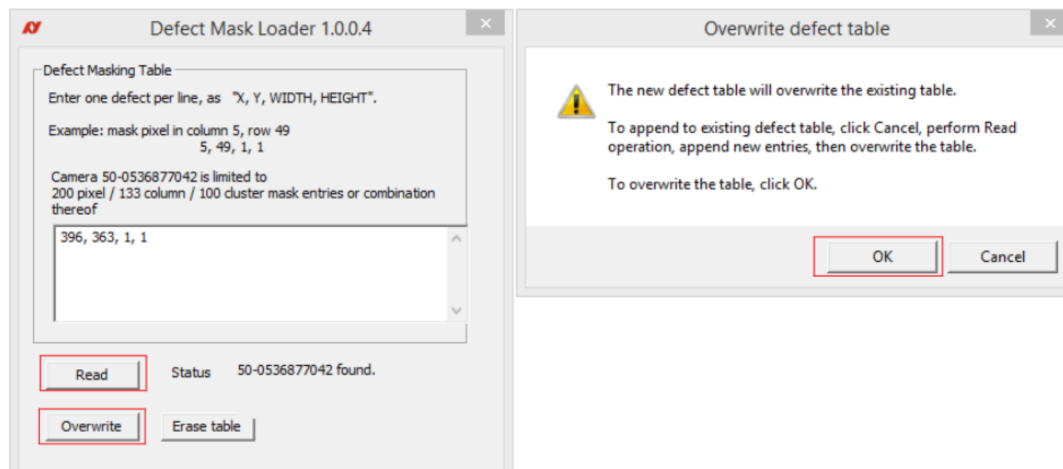


Figure 1: Masking defects using the Defect Mask Loader tool



Prosilica GT4400, GT5400, and GT6400 series support 512 masked pixels.



Defect Mask Loader allows the input of pixel, row, and column masks. However, camera firmware may limit the type of defect that can be masked. For more information on defect masking your camera model supports, refer to your camera technical manual.

If writing a column and row defect to a camera that does not support it, an error message will be given and the entry will not be written to the defect table.

Cluster defect masking is currently not supported. The width and height of each pixel must be set to 1.

Confirming pixel defects are masked

This part uses the **Vimba Viewer**.

1. Connect your Allied Vision GigE camera to the host computer and start **Vimba Viewer**. Wait until the camera is listed in the **Detected Cameras** list. This may take a few seconds.
2. Click on the camera serial number and open the **Features** window by selecting the **All** tab.
3. In **Controls > DefectMaskEnable**, set the feature to `true` to enable the feature.
4. Click the **Freerun** button to initiate live camera view. Right-click on the image and uncheck **Color Interpolation**. Right-click on the image and save the image to the host computer as a TIFF file.
5. Open the saved TIFF file in **ImageJ** or a similar application. Confirm that the pixel defects entered into the tool have been masked.

For technical support, please contact support@alliedvision.com.

Supported pixel defects by model

Family	Models	Masked pixels (maximum)
Mako G	G-030, G-131, G-192, G-223, G-419, G-503	200
Manta G	G-223, G-419	200
	G-1620, G-2040, G-2460	512
Prosilica GT	GT2000, GT2050	200
	GT4400, GT5400, GT6400	512

Table 4: Supported pixel defects by model

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