

Introduction

This document presents instructions on how to mask column defects using the **Load Defect Tables Tool**. The **Load Defect Tables Tool** allows you to manage a user defined pixel defect list to match your application and optimize the life-cycle of the camera.

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 **Load Defect Tables Tool** allows you to mask these pixels along with defect pixels which may be visible due to your specific application configuration.

See the `DefectMask` control section of **Vimba Viewer**. If your camera does not have `DefectMask > DefectMaskEnable` feature, column defect masking is not supported or it is not necessary.



Class 1 and class 0 sensors do not have column defects, and are available on some ON Semi sensors. Contact support@alliedvision.com or your local Allied Vision Sales representative for more information.

Prerequisites

The following items are required:

- Allied Vision GigE camera with `Controls > DefectMaskEnable` feature.
Supported models:
 - Prosilica GT1660, GT1910, GT1920, GT2300, GT2750, GT3300, G3400



Prosilica GT1660, GT1910, GT2300, and GT3300 must run firmware version 01.54.16845 or later.



For Mako G-030, G-131, G-192, G-223, G-419, G-503, Manta G-223, Manta G-419, Prosilica GT2000, GT2050, GT4905, GT4907, and GT6600, refer to the Defect Mask Loader Tool Application Note.

https://www.alliedvision.com/fileadmin/content/documents/products/cameras/various/appnote/GigE/Defect_Mask_Loader_Tool.pdf



For Prosilica GT4090, GT4096, and GT5120, refer to the Defective Pixel List Management Tool Application Note.

https://www.alliedvision.com/fileadmin/content/documents/products/cameras/various/appnote/GigE/Defective_Pixel_List_Management_Tool.pdf

- **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.



To download **Vimba Viewer**:

<https://www.alliedvision.com/en/products/software.html>

- **Load Defect Tables Tool** to mask the column defects.



To download the **Load Defect Tables Tool**, go to:

<https://www.alliedvision.com/en/support/software-downloads.html>



This tool is for use with Microsoft Windows® only.

- Third-party image processing program such as **ImageJ** to inspect the image and identify pixel defects in an image.



To download **ImageJ** go to:

<http://rsbweb.nih.gov/ij/download.html>

Defining defects

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](#).

Detecting pixel defect columns



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.
6. 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).
7. For dark image acquisition you can leave the lens cap attached.
8. 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.



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



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.

- 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**.

Load Defect Tables tool

To connect to a camera

- With **Vimba Viewer** closed, run loaddefects.exe.
- 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.

- Click **Load** to load the current defect pixel list from the connected camera.
- Enter the pixel defect coordinates and click **Save**. For example: 621: 2197, 3544. For a spot defect, enter it as: 621: 2197, 2197.

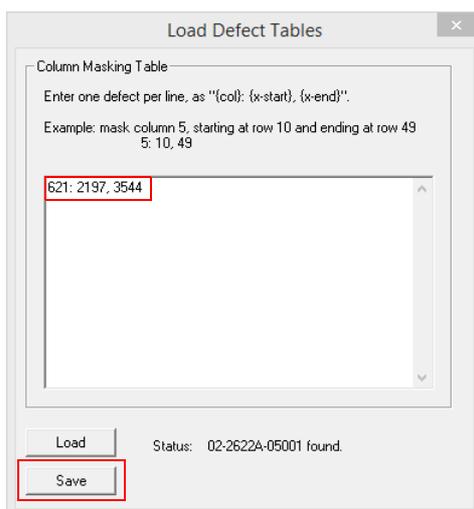


Figure 1: Masking defects using the Load Defect Tables tool



Defect correction averages left and right adjacent pixels for mask value. Therefore, it will not work for clusters, for example, two or more pixels horizontally adjacent.



You can use the Load Defect Tables tool to mask pixel defects (column height 1), but it is limited to 64 entries overall.

Confirm pixel defect columns are masked

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 defect columns entered into the tool have been masked.

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

For comments or suggestions regarding this document, please contact info@alliedvision.com.

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