NI-IMAQ White Balancing Utility Help

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NI-IMAQ White Balancing Utility Help provides conceptual information about Bayer cameras and step-by-step information about using the NI-IMAQ White Balancing Utility with a Bayer camera. This help file is designed for users who are new to using Bayer cameras for image acquisition applications as well as those who have experience with the cameras.

To navigate this help file, use the **Contents**, **Index**, and **Search** tabs to the left of this window.

For more information about this help file, refer to the following topics:

Conventions—formatting and typographical conventions in this help file

Related Documentation

Important Information

Technical Support and Professional Services

To comment on the documentation, email techpubs@ni.com.

Conventions

This help file uses the following conventions:

»	The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.
	This icon denotes a tip, which alerts you to advisory information.
	This icon denotes a note, which alerts you to important information.
bold	Bold text denotes items that you must select or click on in the software, such as menu items and dialog box options. Bold text also denotes parameter names, emphasis, or an introduction to a key concept.
green	Underlined text in this color denotes a link to a help topic, help file, or Web address.
green	Text in this color with a dashed underline denotes a pop-up link to a definition or special term.
italic	Italic text denotes variables or cross references. This font also denotes text that is a placeholder for a word or value that you must supply.
monospace	Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and code excerpts.

Related Documentation

The following documents contain information that you might find helpful as you use this help file:

- *NI-IMAQ User Manual*
- *NI-IMAQ Function Reference Help*
- *NI-IMAQ VI Reference Help*
- *Measurement & Automation Explorer Help for IMAQ*

About Bayer Cameras

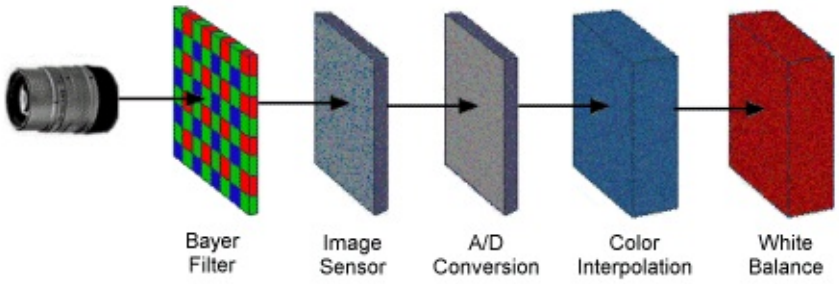
Refer to the following sections for information about various aspects of Bayer cameras.

Bayer Encoding

Bayer encoding is a method you can use to produce color images with a single imaging sensor, as opposed to three individual sensors for the red, green, and blue components of light. This technology greatly reduces the cost of cameras.

The Bayer color filter array (CFA) is a primary color, mosaic pattern of 50% green, 25% red, and 25% blue pixels. Green pixels comprise half of the total pixels because the human eye gets most of its sharpness information from green light.

The following illustration describes how the Bayer CFA is used in the image acquisition process.



Light travels through the camera lens onto an image sensor that provides one value for each sensor cell. The sensor is an array of tiny, light-sensitive diodes called photosites. The sensor converts light into electrical charges. The sensor is covered by the Bayer CFA so that only one color value reaches any given pixel. The raw output is a mosaic of red, green, and blue pixels of different intensity.

When the image is captured, the accumulated charge for each cell is read, and analog values are converted to digital pixel values using an analog-to-digital (A/D) converter.

Color Interpolation

Color interpolation, sometimes referred to as demosaicing, fills in the missing colors. A decoding algorithm determines a value for the RGB components for each pixel in the array by averaging the color values of selected neighboring pixels and producing an estimate of color and intensity.

After the interpolation process is complete, the white balancing process further enhances the image by adjusting the red and blue signals to match the green signal in white areas of the image.

Example

Several decoding algorithms perform color decoding, including nearest neighbor, linear, cubic, and cubic spline interpolations. The following example provides a simple explanation of the interpolation process:

Determine the value of the pixel in the center of the following group:

```
RGR
GBG
RGR
```

These pixels have the following values:

```
200  50 220
 60 100  62
196  58 198
```

Neighboring pixels are used to determine the RGB values for the center pixel. The blue component is taken directly from the pixel value, and the green and red components are the average of the surrounding green and red pixels, respectively.

```
R = (200 + 220 + 196 + 198)/4 = 203.5 ~ 204
G = (50 + 60 + 62 + 58)/4 = 57.5 ~ 58
B = 100
```

The final RGB value for the pixel is (204,58,100). This process is repeated for each pixel in the image.

White Balance

White balance is a method you can use to adjust for different lighting conditions and optical properties of the filter. While the human eye compensates for light with a color bias based on its memory of white, a camera captures the real state of light. Optical properties of the Bayer filter may result in mismatched intensities between the red, green, and blue components of the image.

To adjust image colors more closely to the human perception of light, white balancing assumes that if a white area can be made to look white, the remaining colors will be accurate as well. White balancing involves identifying the portion of an image that is closest to white, adjusting this area to white, and correcting the balance of colors in the remainder of the image based on the white area.

You should perform a white balance every time lighting conditions change. Setting the white balance incorrectly may cause color inconsistencies in the image.

White Level

The white level defines the brightness of an image after white balancing. The values for the red, green, and blue gains are determined by dividing the white level by the mean value of each component color. The maximum white level is 255.

If the white level is too high or too low, the image will appear too light or too dark. You can adjust the white level to fine-tune the image brightness.

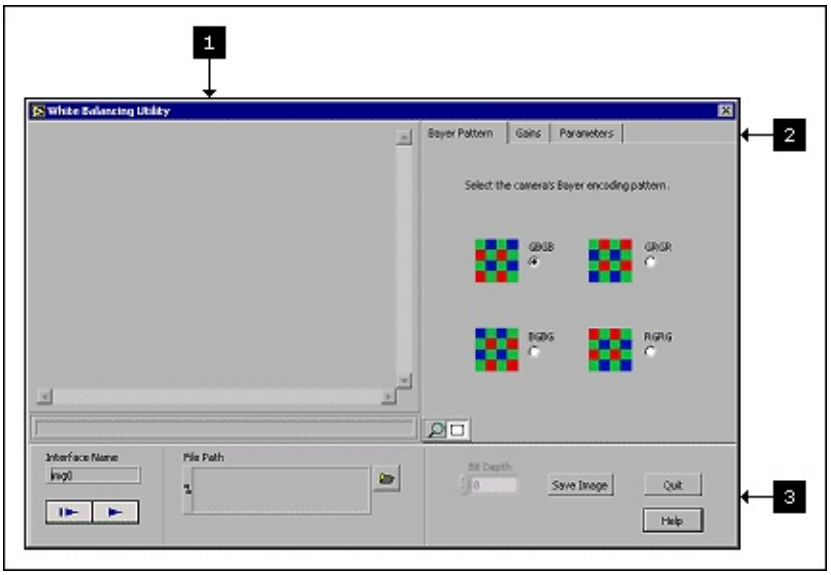
When using the White Balancing Utility, start with the default white level value of 220. Select a region of interest and click **Auto Calculate Gains**. If the image appears incorrect, increase or decrease the white level, select a region of interest, and click **Auto Calculate Gains**. Repeat this procedure until the image appears correct.

Using the NI-IMAQ White Balancing Utility

Understanding the Interface

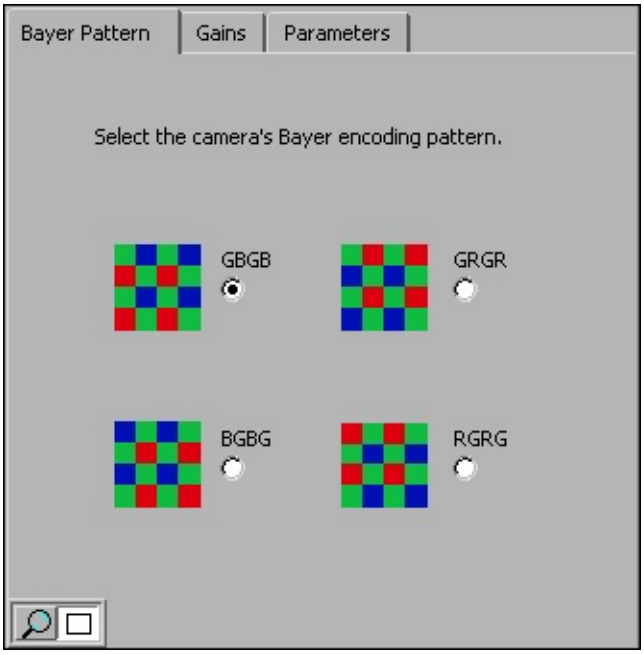
Use the NI-IMAQ White Balancing Utility interface to interactively determine the correct gain settings and sensor pattern for your imaging setup. The proper settings are dependent upon the camera and lighting for a particular system.

You use the gain settings as parameters for the IMAQ Create Bayer LUT and IMAQ Bayer Color Decode VIs in LabVIEW, or for the imgCalculate BayerColorLut() and imgBayerColorDecode() functions in LabWindows/CVI. For information about these VIs and functions, refer to *NI-IMAQ VI Reference Help* or *NI-IMAQ Function Reference Help*.



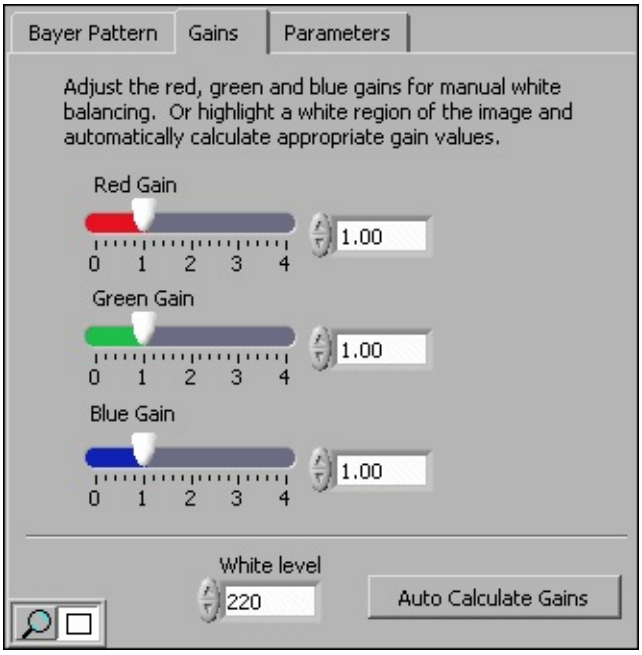
1. **Image window**—Displays the image being processed, allows you to zoom or select a region of interest, and displays cursor location and pixel RGB values.
2. **Utility tabs**—Displays the Bayer Pattern, Gains, and Parameters tabs.
3. **Controls**—Displays controls to acquire images, open an existing image, set the image bit depth, save an image, close the utility, and open this help file.

Bayer Pattern Tab



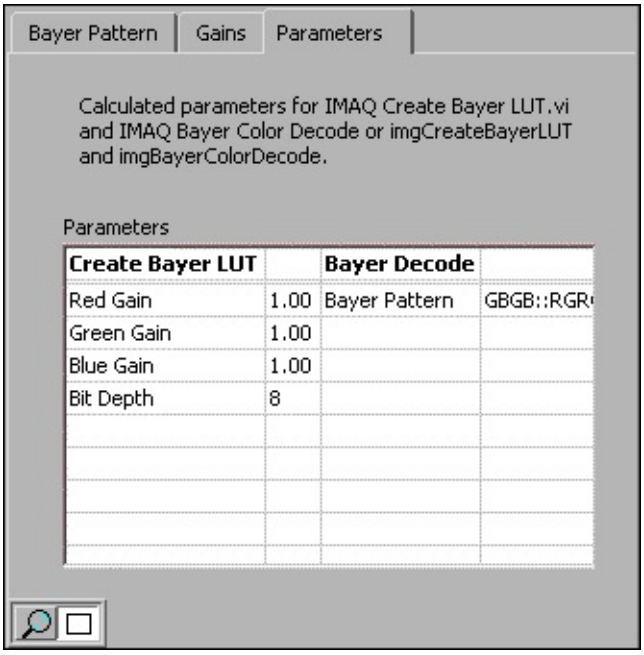
The **Bayer Pattern** tab displays the four possible variations of the Bayer encoding pattern. Use the radio buttons to select the correct pattern for your image. The correct settings may change if the top or left offset is modified.

Gains Tab



The **Gains** tab displays controls to adjust the image RGB gains and white level. Select a region of interest, set the white level, and click **Auto Calculate Gains** to calculate the gain values.

Parameters Tab



The **Parameters** tab displays the calculated RGB gain, bit depth values, and the Bayer encoding pattern for an image. Record the displayed values to use in your application with the imgBayerColorDecode and imgCalculateBayerColorLUT functions or IMAQ Create Bayer LUT and IMAQ Bayer Color Decode VIs.

Using the Utility with an Acquired Image

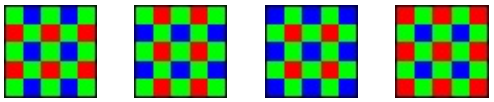
Complete the following steps to acquire an image and find the correct gain settings for an image:

1. Verify that your image acquisition device and camera are correctly configured using Measurement and Automation Explorer (MAX). Refer to *Measurement & Automation Explorer Help for IMAQ* for information about configuring your image acquisition device and camera.
2. Launch the NI-IMAQ White Balancing Utility from **Programs»National Instruments»Vision»Bayer White Balancing Utility**.
3. Click the **Snap** button  to acquire a single image, or click the **Grab** button  to capture images in continuous mode.

    **Tip** Use an image with distinct areas of red, green, blue, and white to determine the correct settings. If you have a color printer, you can print and use the RGB Image Example.

4. Select the **Bayer Pattern** tab and select the appropriate **Bayer Encoding Pattern** for the image.

    **Note** The Bayer CFA pattern can appear in one of the following four variations, depending on the current left and top offsets of the acquisition window:

   GBGB GRGR BGBG RGRG
   RGRG BGBG GRGR GBGB

5. Select the **Gains** tab.

6. Set the desired white level. The default white level value is 220.
7. Click the **ROI** button  and select a white region of interest on the image.
8. Click **Auto Calculate Gains** to calculate the RGB gain settings.

   Note You also can use the individual **Gain** controls to manually adjust the white balance.

9. Select the **Parameters** tab and record the displayed values to use in your application.

   Use these calculated parameters with the imgBayerColorDecode and imgCalculateBayerColorLUT functions or IMAQ Create Bayer LUT and IMAQ Bayer Color Decode VIs.

For more information about finding the correct gain settings, refer to About Bayer Cameras and NI-IMAQ White Balancing Utility FAQs.

Using the Utility with an Existing Image

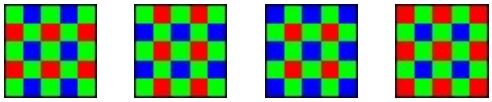
Complete the following steps to open an existing image and find the correct gain settings for an image:

1. Launch the NI-IMAQ White Balancing Utility from **Programs»National Instruments»Vision»Bayer White Balancing Utility**.
2. Click the **Browse** button  .
3. Select the image you want to open.
4. Click **OK** to open the selected image.
5. Set the appropriate **Bit Depth** value for the image.

   Note Images that are eight bits are automatically detected and the **Bit Depth** is grayed out. Until the correct bit depth is set, images that are greater than eight bits may appear very light or very dark. An incorrect bit depth causes incorrect gain settings.

6. Select the **Bayer Pattern** tab and click the appropriate **Bayer Encoding Pattern** radio button for the image.

   Note The Bayer CFA pattern can appear in one of the following four variations, depending on the current left and top offsets of the acquisition window:

   GBGB GRGR BGBG RGRG
   RGRG BGBG GRGR GBGB

7. Select the **Gains** tab.
8. Set the desired white level. The default white level value is 220.

9. Click the **ROI** button  and select a white region of interest on the image.
10. Click **Auto Calculate Gains** to calculate the RGB gain settings.

    Note You also can use the individual **Gain** controls to manually adjust the white balance.

11. Select the **Parameters** tab and record the displayed values to use in your application.

    Use these calculated parameters with the imgBayerColorDecode and imgCalculateBayerColorLUT functions or IMAQ Create Bayer LUT and IMAQ Bayer Color Decode VIs.

For more information on finding the correct gain settings, refer to About Bayer Cameras and NI-IMAQ White Balancing Utility FAQs.

Saving an Image

Complete the steps below to save a color BMP image file for the first time or to make a copy of an existing image:

Note BMP color images use 8 bits per color plane.

1. Click the **Save Image** button.
2. Enter a new **File name**.
3. Click **Save**.

Closing the NI-IMAQ White Balancing Utility

Complete these steps to close the NI-IMAQ White Balancing Utility interface:

1. Save the images you want to keep.
2. Click **Quit**.

Reference

FAQs

RGB Image Example

NI-IMAQ White Balancing Utility FAQs

Why do the colors in my image look incorrect after auto white balancing?

The most common cause of incorrect color decoding is an incorrect Bayer pattern selection. The correct Bayer pattern depends on the camera sensor, but also can be affected by the left and top offsets of the current acquisition window. Click the **Bayer Pattern** tab, choose a different pattern, and perform the white balance again.

Which Bayer encoding pattern should I use?

Because the correct pattern is dependent on the left and top offsets of the current acquisition window, use the following trial and error procedure to find the correct Bayer pattern:

1. Click the **Bayer Pattern** tab and select a **Bayer Encoding Pattern**.
2. Click the **Gains** tab.
3. Click the **ROI** button  and select a white region of interest on the image.
4. Click **Auto Calculate Gains**.

Repeat this procedure until the colors appear correct.

Why does my image still look incorrect or appear to be dominated by one color after I have tried all of the Bayer patterns?

Make sure the **Bit Depth** value matches the bit depth of the camera. Try changing the gain and exposure of the camera. Images that are too dark or too light may adversely affect the gain calculations.

Why does my image appear all white?

Make sure the **Bit Depth** value matches the bit depth of the camera.

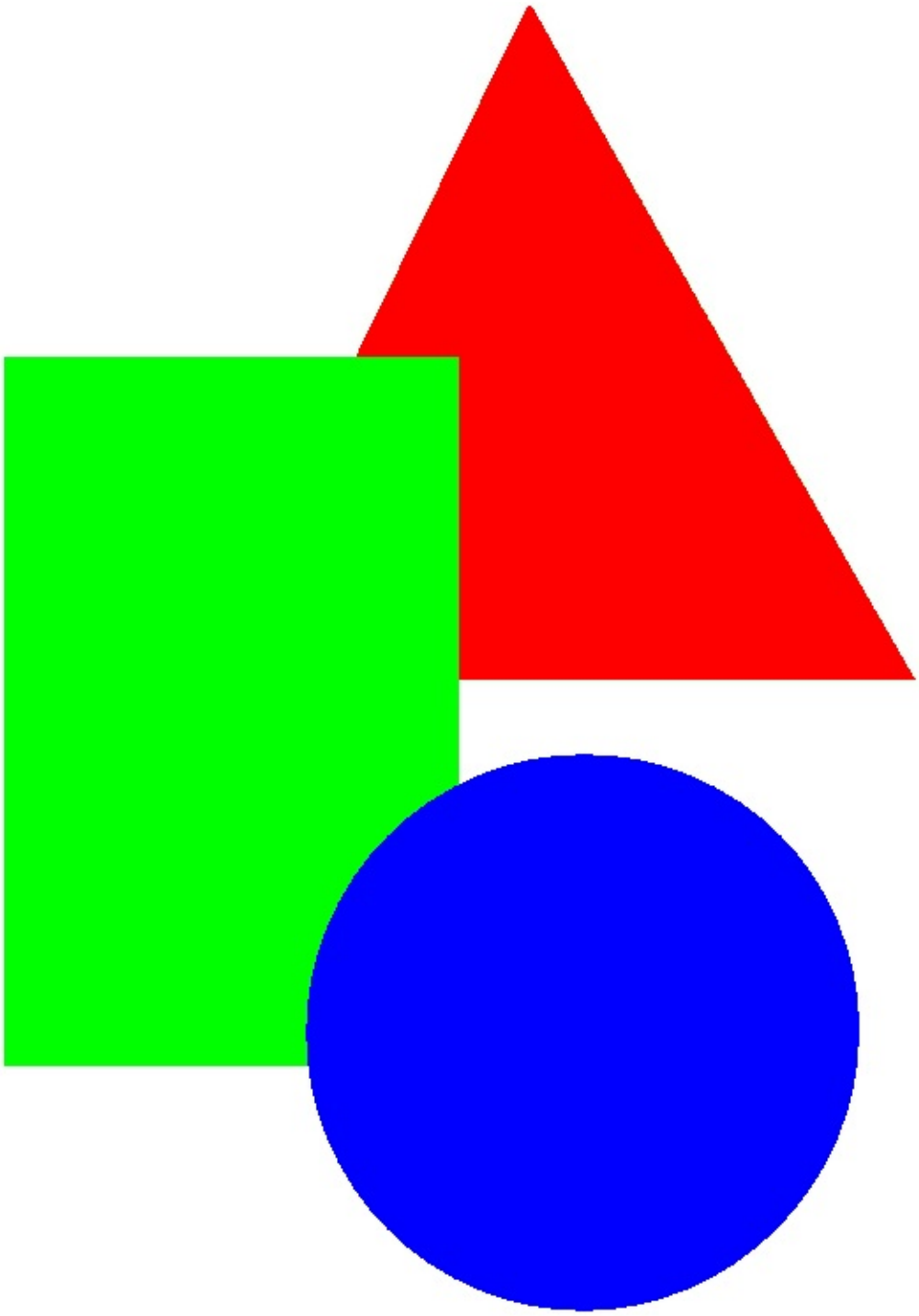
Why does my image appear washed out?

The maximum value for the individual color gains is 3.99. If any of the gains reached the maximum value after white balancing, the image may have been too dark to begin with and the gain was not able to compensate. Increase the gain or exposure on the camera, take a new image, and perform the white balance again.

I have a 10-bit Bayer sensor, but BMP saves only 8 bits per color plane. What happens to the other 2 bits?

Currently, the Bayer decoding algorithm supports only 8 bits per color plane. The Bayer decoding algorithm uses all bits to appropriately scale the data to 8 bits per color plane.

RGB Image Example



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Finland	385 0 9 725 725 11
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Germany	49 0 89 741 31 30
Greece	30 2 10 42 96 427
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