

APPLICATION NOTE

```
// Create an instant camera object with the first
Camera_t camera( CTIFactory::GetInstance().Creat

// Register an image event handler that accesses
camera.RegisterImageEventHandler( new CSampleImage
Ownership_TakeOwnership);

// Open the camera.
camera.Open();
```

Setting up a Basler sprint Color Camera With a Matrox Solios Frame Grabber

Document Number: AW001205

Version: 03 Language: 000 (English)

Release Date: 12 February 2013

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Purpose of this Document

This document describes

- what you should observe when setting up a Basler sprint color camera in combination with a Matrox Solios frame grabber. For information on Matrox frame grabber types, see below.
And
- how to realize the gamma correction, white balance and color adjustment settings in the Basler sprint camera.

For detailed information on the RGB color space and hue and saturation adjustment, see the Basler sprint User's Manual AW000699xx which is available on the Basler website.

Information on the Matrox frame grabbers

Depending on the data traffic (speed) and depending on the used bus system of your PC the following Matrox frame grabbers were used at the Basler fab. Others frame grabber types are also possible, but are not scope of this document. Please see the “Compatible Products” pages in the support section on our website).

- Solios eCL - 85 MHz PCIe[™] Camera Link
- Solios6MCL/E - 66 MHz PCI- X[®]/PCIe[™] Camera Link

Prerequisites

Hardware

Make sure that you have

- ... installed the corresponding **Matrox frame grabber** in your PC.
 1. Make sure that the frame grabber has enough memory so that it can save enough camera lines. Evaluate the required memory.
 This depends on the selected line acquisition mode (RGB line acquisition mode, Raw line acquisition mode or Enhanced Raw line acquisition mode) and on the selected camera model.
 You can set the frame grabber to the correct mode via **MILConfig > Non page Memory**.
 If you require a higher storage demand (e.g. for color images in RGB mode), set the storage value to 200 – 256 MB. If you do not adapt the value, there can be error messages.
 For detailed information on interfacing cameras to Matrox Imaging hardware, go to <http://www.matrox.com/imaging/en/support/cameras/>.
- Frame grabber type A:
 Solios eCL (85 MHz) with PCIe™ Bus and CL (Camera Link):
 This frame grabber runs in full mode (-F). You do not have to adapt any settings, as the frame grabber is able to cope with all settings realized in the sprint camera (i.e. no matter what mode you select in the camera).
- Frame grabber type B:
 Solios6MCL/E (66 MHz) with PCI-X®/PCIe™ Bus and CL (Camera Link):
 This frame grabber can run in different modes (*Base* or *Medium*). Therefore you have to make sure that the camera mode and the frame grabber mode are adapted to each other.
 1. Make sure that the correct frame grabber mode is set in the **MIL Config** tool (select > **Programs > Matrox Imaging > Tools > MILConfig**).

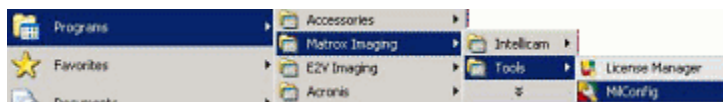


Figure 1: How to Start MIL Config Tool

2. If you modify this setting, make sure that you power-cycle the PC afterwards.

- ... installed, powered up and configured the Basler **sprint color camera** and realized the basic camera settings following the Basler sprint color user's manual.
 To obtain best performance from color models of the camera, use of a dielectric IR cut filter is recommended. The filter should transmit in a range from 400 nm to 650 nm, and it should cut off from 650... 680 nm to at least 1100 nm.

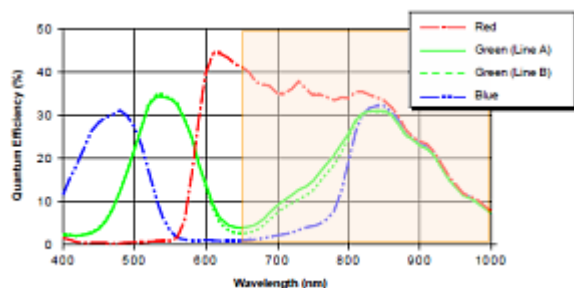


Figure 2: Camera Spectral Response

You can check the [frame rate](#) of your camera model on the Basler website.

In order to communicate with the corresponding camera, the camera must

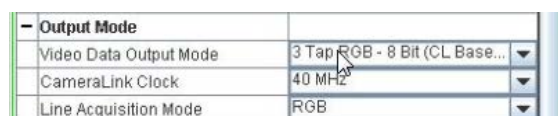
- be connected to the frame grabber via the emulated serial interface and
- be selected.

Software

Make sure that you have installed

- ... the Matrox **MIL** (Matrox Imaging Library) **processing pack** on your PC.
The image capture is realized by the Matrox Imaging Library (**MIL**). A "Lite" version is sufficient for your tasks. This includes the **MIL Configuration** tool for configuring the frame grabber and the **MIL Intellicam** tool for displaying the images.
- ... the **Basler CCT+** tool for configuring the Basler sprint camera parameters.
You realize the camera settings in the CCT+. You can download a free version on the Basler website ([Camera Configuration Tool](#)) – here the newest version is available.

- ... the corresponding ***.dcf** files.
These are configuration files required by the frame grabber and can be set via the **MIL** processing pack (**MIL Configuration**).
The ***.cfg** file contains settings representing the camera video data output mode, the camera link clock speed and the line acquisition mode. Figure 3 shows a parameter example as they are displayed in the Basler CCT+ tool. The parameter in the CCT+ tool and the ***.dcf** file must correspond to each other.



Output Mode	
Video Data Output Mode	3 Tap RGB - 8 Bit (CL Base...)
CameraLink Clock	40 MHz
Line Acquisition Mode	RGB

Figure 3: Configuration Data

You have the following possibilities: You can

- ... set the parameters in the default ***.dcf** file (via **New** command)
or
- ... load an existing ***.dcf** file already containing the basic settings for the corresponding mode. Ideally, there are three different ***.dcf** files for the different modes (RGB..., Raw... and Raw Enhanced ... mode).
Or
- ... use existing data configuration sets: In the following download section on the Matrox website ([Download](#)) there are data configuration files (***.dcf**) for camera models that are supported.
If you cannot find the required ***.dcf** file, use an existing file as sample and adapt the settings.

Note

The MIL9 processing pack compared to the MIL8 processing pack offers more useful features (e.g. you can zoom with MIL9 but not with MIL8). We recommend using the MIL9 processing pack.

- ... the firmware for the Basler sprint camera.
You can check the version of your camera in the CCT+.
We recommend to upload the newest firmware version on your camera, so that certain functions are available (e.g. *<Gain Green 2>* and *<RAW Line B first>* should be available). If you want a newer version, please contact Basler Technical Support.

Tools and Materials

Standard Color Chart

Used as a reference for adjusting the white balance /gamma and the basic colors.

We recommend including a standard color chart within your camera's field of view. This will make it much easier to know when the colors are properly adjusted.

One widely used chart is the ColorChecker® chart (also known as the Macbeth chart). If you order a color checker chart, the target values for red, green and blue will be indicated on the chart for each color field ([ColorChecker®](#)).

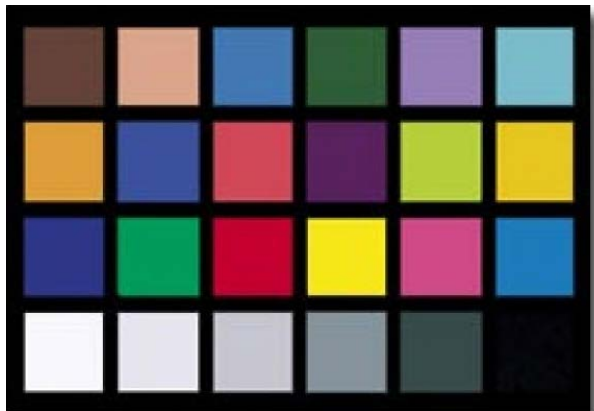


Figure 4: ColorChecker® Chart

Tools for Displaying Color Values

Make sure that a tool is installed on your computer that helps you to identify the color value of any pixel in an image and to compare it to the original.

The tool should be able to display the colors as RGB values and as HSB/HSV values.

Example tool: Just Color Picker ([Just Color Picker](#) free version), or an alternative program is the [pkColorPicker](#).



Figure 5: Just Color Picker User Interface

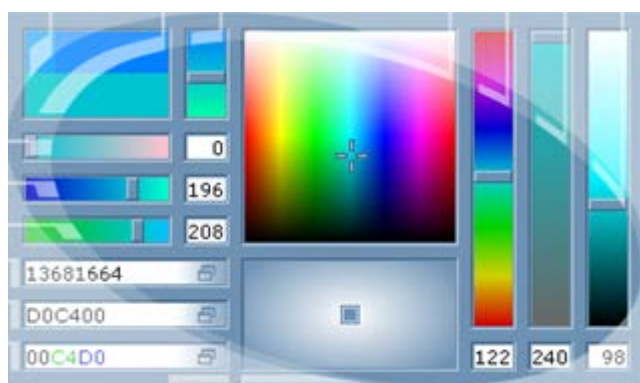


Figure 6: pk Color Picker User Interface

Additional Information on the Matrox Intellicam Tool

For displaying the camera images you require the Matrox application **Intellicam** which is part of the **MIL** software package. Figure 7 shows you the symbol bar of **Intellicam**.



Figure 7: Symbol Bar in "Intellicam" Tool; (1) = 'Bayer' Button

The **Bayer** button (1) in Figure 7 opens the **Configure Bayer Settings** dialog box (see Figure 8).

The indicated Bayer pattern corresponds to the first two pixels that are transmitted. For information on the Bayer filter used in your camera model, see the technical specifications table in the Basler sprint user's manual. As an alternative you can check the Bayer pattern effect by displaying single-colored test images in the CCT+.

The MIL 9 processing pack has an additional **Enabled** option button (compared to the MIL8 version). Therefore, for MIL9 versions you do not need to distinguish between **Safe grab** and **Safer Bayer Grab**.

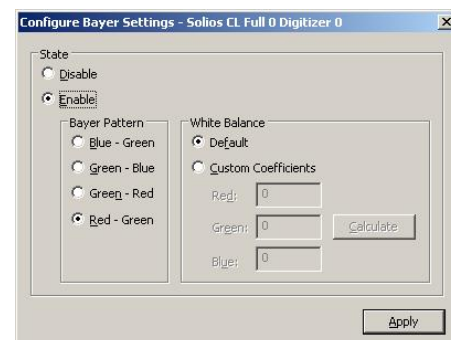


Figure 8: Configure Bayer Settings

Depending on the line acquisition mode (RGB, Raw or Raw Enhanced line acquisition mode) and on the preprocessing (debayering) (e.g. converting Raw data into color data) the following Matrox settings can vary:

- Use of the Bayer pattern
- Tap configuration
- Standard RGB or monochrome

Output Mode	
Video Data Output Mode	3 Tap RGB - 8 Bit (CL Base...)
CameraLink Clock	40 MHz
Line Acquisition Mode	RGB

Figure 9: Camera Configuration Data

Option

The MIL software can convert monochrome Raw image information into color information.

This is required for real-time applications. If the images are to be processed and calculated in subsequent steps, the monochrome values of the images must be used for the transfer. Raw Enhanced image information always has to be captured in monochrome.

Image Acquisition With the Matrox Intellicam Tool

You have two possibilities to capture images:

- You can use the icons in the symbol bar (see Figure 10) or
- You activate the commands in the **Digitizer** menu (e.g. **Single Grab** or **Continuous Safe Grab**) (see Figure 11)



Figure 10: Icons for Image Acquisition in the Intellicam Symbol Bar

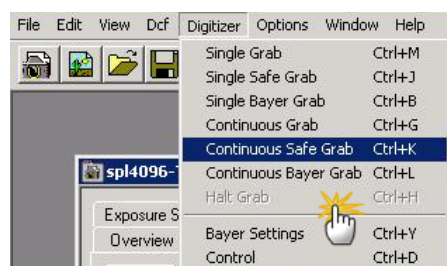


Figure 11: Digitizer Menu

It is important that the camera settings **are adapted to** the frame grabber settings.

If this is the case, and you use the icons with the additional (S), the Solios frame grabber will work faultlessly:

- If you activate a button with a **camera icon**, single images are taken.
- If you activate a button with a **film camera icon**, images are taken continuously.

MIL9 offers useful zooming functions (see Figure 10).

Note on status line in MIL

In the MIL status line the following useful information is displayed (see marked section in Figure 12):

Example:

(1136, 687) →

indicates the mouse position in the image

= 0xFE, E7, B5 →

indicates the color values for red, green and blue in hexadecimal notation

Restriction:

These values are only displayed, if the image capture is stopped.

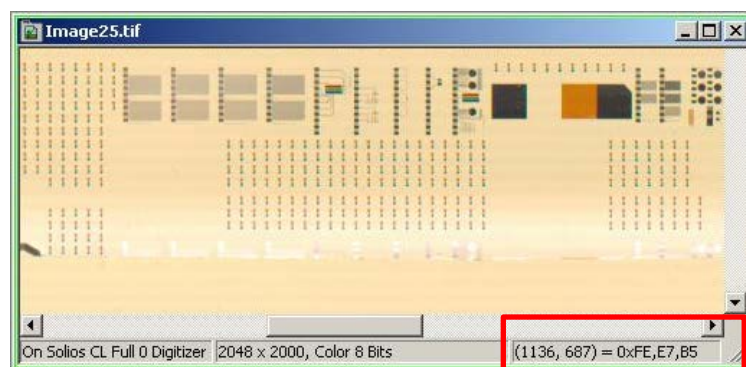


Figure 12: Status Line in MIL

If you want the MIL **Intellicam** software to realize Bayer functions:

- With MIL8: via Bayer Grab Instructions
- With MIL9: via Safe Grab Instructions

The corresponding icons are displayed in Figure 13

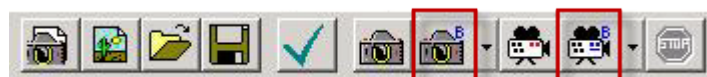


Figure 13: Icons for Bayer Grab

Additional Information on the Matrox Configuration Tool

The connection from the camera to the frame grabber hardware is realized via configuration parameters. These configuration parameters are stored in a *.dcf files.

*.dcf files can be created, loaded and saved.

(1)



Figure 14: 'Load' and 'Save' Command Buttons for *.dcf Files

Via **File > Open** you can load a *.dcf file.

The following screenshots show you settings valid for RGB, Raw and Raw Enhanced mode in the MIL configuration tool. You do not need to change them in the MIL processing pack software. They are set in the CCT+.

1. Check the **Pixel clock frequency** parameter.
Depending on the frame grabber type this parameter limits the data speed. In some cases a restriction is required.
2. Check the **Image Size Y** parameter because it is important for the frame rate. The **Image Size Y** parameter represents the number of lines per image. It is restricted by the memory space (acquisition error) and influences the image generation.
During the set-up, when you take live images, set this parameter to 200 (lines).

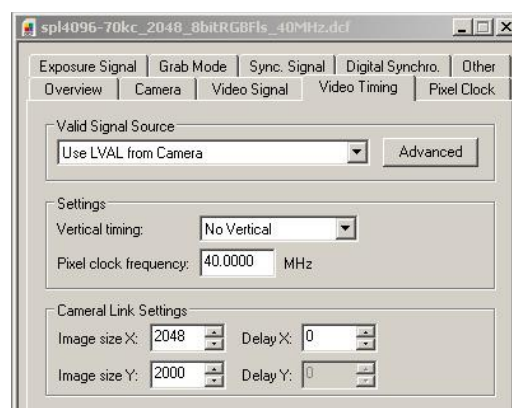


Figure 15: Configuration Settings in MIL

Note

- The **Image Size X** parameter is the line width per tap. For a 4k camera configured with 2 taps this parameter is 2048.
- If the value of the pixel clock frequency is divided, the line width is automatically adapted.

Additional information

Even if the configuration software allows to control the camera via the video signal of the frame grabber, we recommend to use the CCT+ software for programming/configuring the camera's acquisition, because it is more comfortable.

1. On the **Grab Mode** tab:
Make sure that the **Line scan mode** frame grabber parameter is set to **Free Run**.

You realize the configuring of the video signal parameters (line and exposure time) directly in the camera (via CCT+).

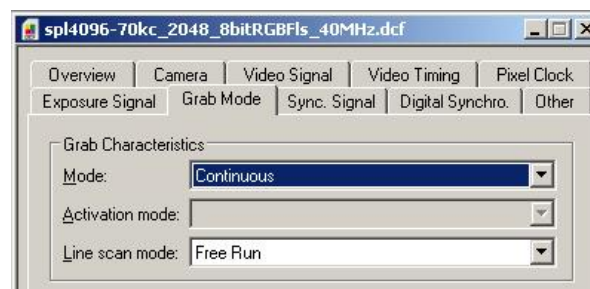


Figure 16: 'Grab Mode' Tab in MIL

Additional Information on the CTT+

You can either configure and adjust the frame grabber first and then the camera settings or vice versa. But make sure that both settings are adapted to each other.

For the **CCT+** tool the configuring mainly consists of setting the camera **output mode** and the **image capture**.

CL Base → Communication via camera link with one cable.

CL Medium → Communication via camera link with two cables.

For each tap a parallel transmission is realized. This is done via the **MIL Config** tool, in the frame grabber configuration ***.dcf** file. RGB Color is the standard video signal.

Depending on your requirements, you can set the following line acquisition modes: RGB or Raw or Raw Enhanced acquisition mode transferred by several tap configurations. The video signal RGB Color is set by default.

For each tap a parallel transmission is realized. The amount depends on the frame grabber mode set via the **MIL Config** tool, and in the frame grabber configuration ***.dcf** file.

You must set the mode type in the **CCT+**.

The number of taps, if required, the clock speed and the video signal standard from RGB color to monochrome must be set in the **MIL Config** tool and saved in the ***.cfg** file accordingly.

1. Make sure that the parameters in the CCT+ and the ***.cfg** file correspond to/are adapted to each other.

If the basic settings of the frame grabber and camera have been realized and the settings are adapted to each, an uncorrected image can be displayed.

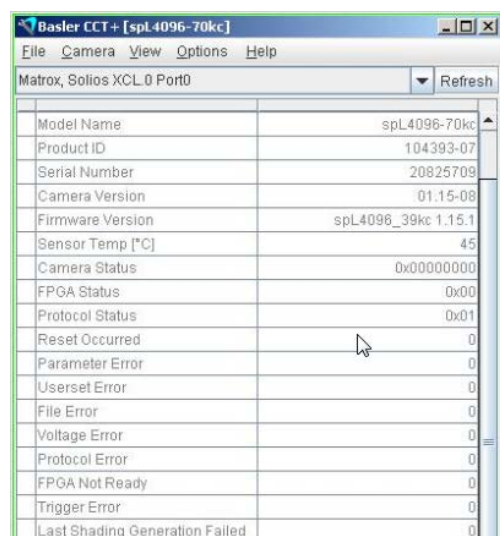


Figure 17: Information in the CCT+

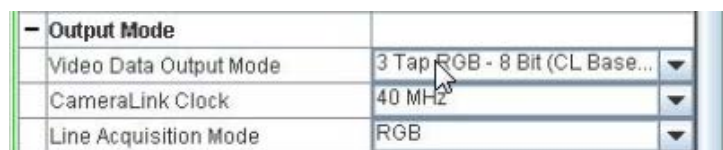


Figure 18: Output Mode Parameters Set in the CCT+ (Example 1)

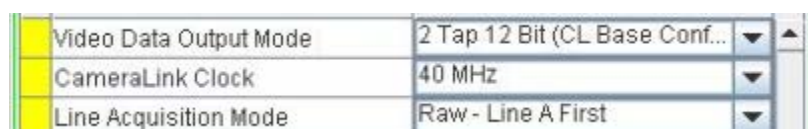


Figure 19: Output Mode Parameters Set in the CCT+ (Example 2)

Information on line acquisition mode 'Raw – Line x First'

This parameter determines the transport direction. In older firmware versions the 'Raw – Line B First' acquisition mode is not available, only the 'Raw – Line A First'.

The easiest way to realize an image capture, if the camera is in the free-run, programmable. You do not need to realize special settings for this in the frame grabber; they are ignored. The video timing values are set in the camera (**Line Period [μs]**, **Exposure Time [μs]**).

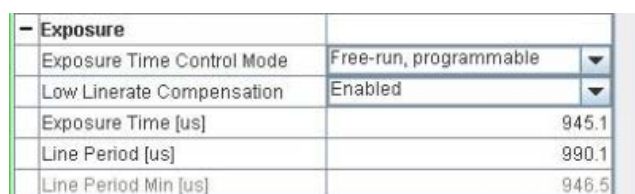


Figure 20: Exposure Parameters in CCT+

Specifics

If you select the RGB signal standard, the direction of transport is not important, because all color information is processed by the camera.

If you use raw signals, you must observe the direction of transport / the sequence of the two sensor lines of the camera.

- If you use the default settings, realize the settings as indicated in Figure 21.
- If the direction of transport is different, or the camera is mounted in another way, you can adapt the line acquisition mode settings accordingly (e.g. ... **Line B first**)

Note

If the Camera link medium cable is connected at the upper side of the camera side (see Figure 21), pixel 0 is at the left side (see Figure 21).

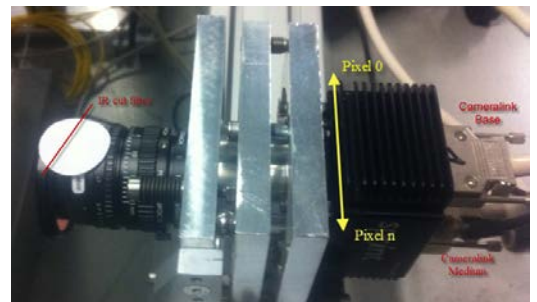


Figure 21: Default Settings (Camera Position and Transport Direction)

How to Adjust the Camera (Gamma, White Balance, Color Settings)

NOTE	The color enhancement feature is available for the following cameras: all Basler sprint 2k and 4k color cameras and, in case of the 8k cameras, the feature is available for the spL8196-50kc .
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NOTE	The following description is also part of the Basler sprint color User's Manual. Please see on the Basler website for the newest version of this section in the Basler sprint color User's Manual.
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On the initial wake-up after delivery, the Basler sprint color camera loads the factory configuration set into the work set. The color enhancement feature is deactivated in the factory configuration set. This factory set contains neutral values concerning color settings.

Depending on what you want to achieve by adapting the color adjustment settings, you have the following possibilities:

- (A)
If a **high color accuracy** is important to you, i.e. you want the camera to capture an object and you want the monitor to display the colors of an object as seen under a standard light source (i.e. the **exact numerical values** of the object's pixels), make sure that you use a standard color chart within your camera's field of view when you adjust the color enhancements.
- (B)
If you want to rely on your visual impression, i.e. you want to achieve that the monitor you use displays the colors of the captured object as you perceive them, you require a high-end, calibrated monitor.
 - Use a high-end, calibrated monitor for displaying your acquired images.
 - Use a standard color chart within your camera's field of view when you adjust the color enhancements.

NOTE	You can only obtain good color enhancements with a well-adjusted monitor (e.g. brightness etc.).
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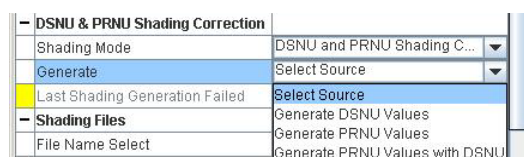
1. Make sure that you use an IR cut filter on the camera lens.

The filter should transmit in a range from 400 nm to 650 nm, and it should cut off from 650...680 nm to at least 1100 nm (e.g. B + W 486 filter).

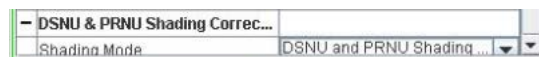
2. Arrange your camera so that it is viewing a scene similar to what it will view during actual operation.
3. Make sure that the lighting for the scene is as close as possible to the actual lighting you will be using during normal operation.
4. Set the exposure time and gain so that you are acquiring good quality images.

It is important to make sure that the images are not over-exposed. Over exposure can have a significant negative effect on the fidelity of the color in the acquired images.

5. Carry out DSNU (Dark Signal Non Uniformity) and PRNU (Photo Response Non Uniformity) **shading correction**:
 - a. Close the lens of the camera (with a cap).
 - b. In CCT+:
 - a) Set **Exposure : Exposure Time Control Mode <Free-run, programmable>**
 - b) In the **DSNU & PRNU Shading Correction** group: Select **Generate DSNU Values**.
If the generation is successful, **Last Shading Generation Failed** is **<0>**.
 - c. Remove the cap from the camera lens.



- d. Capture an image of a homogeneous surface (just below the saturation in the object plane); e.g. white sheet of paper.



- a. In CCT+:

In the **DSNU & PRNU Shading Correction** group: Select **Generate PRNU Values with DSNU Values**.

If the generation is successful, **Last Shading Generation Failed** is <0>.

The values are internally saved. If the procedure is successful, 'Last Shading generation Failed' is 0.

The shading values will be saved automatically in the user shading values file. Make sure the shading mode is selected.

6. Depending on your light source, set the corresponding Offset [DN] and color-specific gain parameters for **white balance** in the [Gain & Offset] section.

- a. Capture images of the gray fields of the color checker.

The brightest (white field) should be in the focus area of the camera and it should not be saturated.

Preferably you should start with a gain value of 1 for the 'strongest' color, because this means lower values and less noise.

- b. Check whether the white balance in the image is correct, i.e. if the values of the colors red, green and blue inside a segment (preferably the brightest) are the same.



Figure 22: Checking White Balance

Via the white balance parameters you adapt the three color channels of the camera (red, green and blue) to the light source in such a way that you obtain a basic gray value.

- c. Set the gain value of the color with the highest gain value as low as possible. Thus you obtain the lowest noise.
- If the white balance is correct, proceed with step 8.
 - If the white balance is not correct, see the following step.

7. If the white balance is not correct, adjust the corresponding color gain parameter in the [Gain & Offset] section.

Note

The following figures show white balance examples of a gray value line displayed in ColorChecker®.

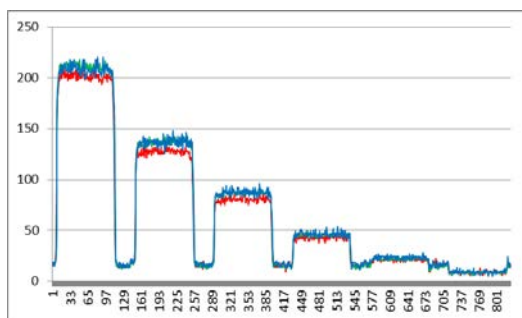


Figure 23: Image with Basic Camera Settings

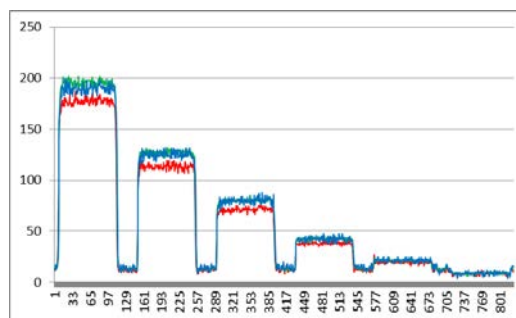


Figure 24: Same Settings + Use of IR Cut Filter

In Figure 24 you can see the reduction of the red spectral components. This is why the IR cut filter must be mounted before setting the white balance parameters.

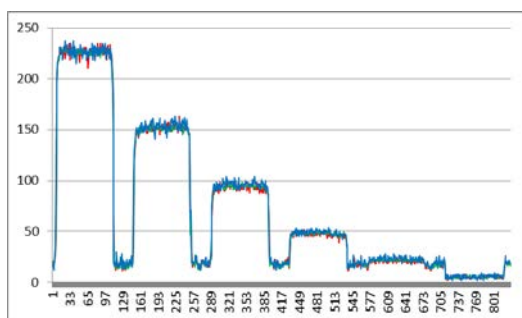


Figure 25: Image with White Balance Influence

In Figure 25 you can see the influence of a completed white balance.

The global gain makes sure that the brightest field is below the saturation. The gain of the single colors were changed in such a way that red, green and blue in the image have equal values.

8. Adjust the **gamma correction** parameters:
 - a. Set the gamma parameter:

Info

The standard value for gamma in sRGB is 0.42. An incorrect gamma value means that the saturation of the colors will change with the brightness.

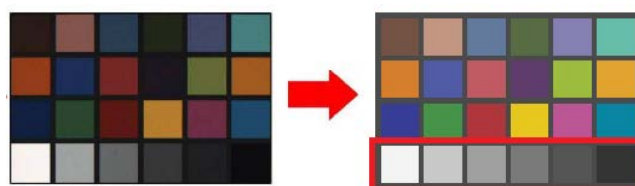


Figure 26: Setting the Gamma Value

Gamma = 1 means no adaptation. **Only** set gamma to 1, if image evaluations later on include this step or if you want to obtain a higher contrast (the higher contrast can only be obtained by simultaneously losing details in the dark areas of the image) and you do not need any color adaptations.

If you use another color space, set the gamma value to the corresponding value. When gamma is set correctly, there should be a smooth transition from the lightest to the darkest gray scale targets on your color chart (see example in Figure 26).

9. Save the current settings that will reflect the status before color adjustment as a user set.

This user set will include the results from white balance and gamma correction.

Depending on your light source, set the corresponding color enhancement parameters in the [Color Adjustment] section. The table in the “

10. List of Color Settings for Different Light Sources” section (on page 15) shows you the values for different light sources.

11. Take again an image of the white and gray fields of the color checker (see example Figure 22).

The displayed image on the monitor should look like the image in Figure 22.

If the displayed image does not correspond to the captured line, check whether the monitor is correctly adjusted.

12. Capture images of the blue, green, red, yellow, magenta and cyan line of the color checker (see example in Figure 27).

13. Check whether the colors are correct.

- If the colors are correctly displayed, the color enhancement is complete.
Go to step 14.
- If the colors are not correctly set, proceed with the next step.



Figure 27: Checking the Colors

- Depending on what color is not correctly displayed, adjust the corresponding **color enhancement** parameters in the [Color Adjustment] section (see Figure 28).
- Set the viewing tool (e.g. Just Color Picker) to HSB/HSV mode.
- Capture a new image of the ColorChecker®.
- Compare the values of the captured image to the reference image on your PC.
- Adjust the primary and secondary colors as close as possible to the values of the reference image by adjusting the corresponding saturation and hue color parameter.
 - See parameters for the different light sources in Table 1 on page 15 and
 - Hue and saturation adjustment are explained in the Basler sprint User's manual.

Color Adjustment	
Color Adjustment Enable	Enabled
Saturation Red	64
Hue Red	0
Saturation Yellow	64
Hue Yellow	0
Saturation Green	64
Hue Green	0
Saturation Cyan	64
Hue Cyan	0
Saturation Blue	64
Hue Blue	0
Saturation Magenta	64
Hue Magenta	0

Figure 28: Color Adjustment Default Parameters in CCT+



Neighboring colors will influence each other, e.g. changes for yellow may also slightly change red and green.

- Save the settings (i.e. with the modified color enhancement parameters) to a separate user set.

If not saved in a special user set, the settings made for color adjustment will be lost when the camera is reset or switched off and back on.

Additional Information

Each of the six primary and secondary colors is separately adjusted in the HSB color space. Only similar colors as red and magenta are influencing each other.

The example parameter at the right side were evaluated with the following illumination:

Fluorescence tube Osram Lumilux L58W/865 cold white, 6500K and gamma = 0.45

The following HSB target values of the ColorChecker® are to be obtained (see Figure 29):

191° 95% 63%
323° 54% 73%
50° 87% 91%
357° 69% 69%
122° 53% 58%
237° 63% 59%

Color Adjustment	
Color Adjustment Enable	Enabled
Saturation Red	72
Hue Red	12
Saturation Yellow	90
Hue Yellow	0
Saturation Green	110
Hue Green	10
Saturation Cyan	100
Hue Cyan	25
Saturation Blue	70
Hue Blue	-15
Saturation Magenta	98
Hue Magenta	0

Figure 29: ColorChecker® RGBYMC Target Values

List of Color Settings for Different Light Sources

Table 1: Color Settings for Different Light Sources

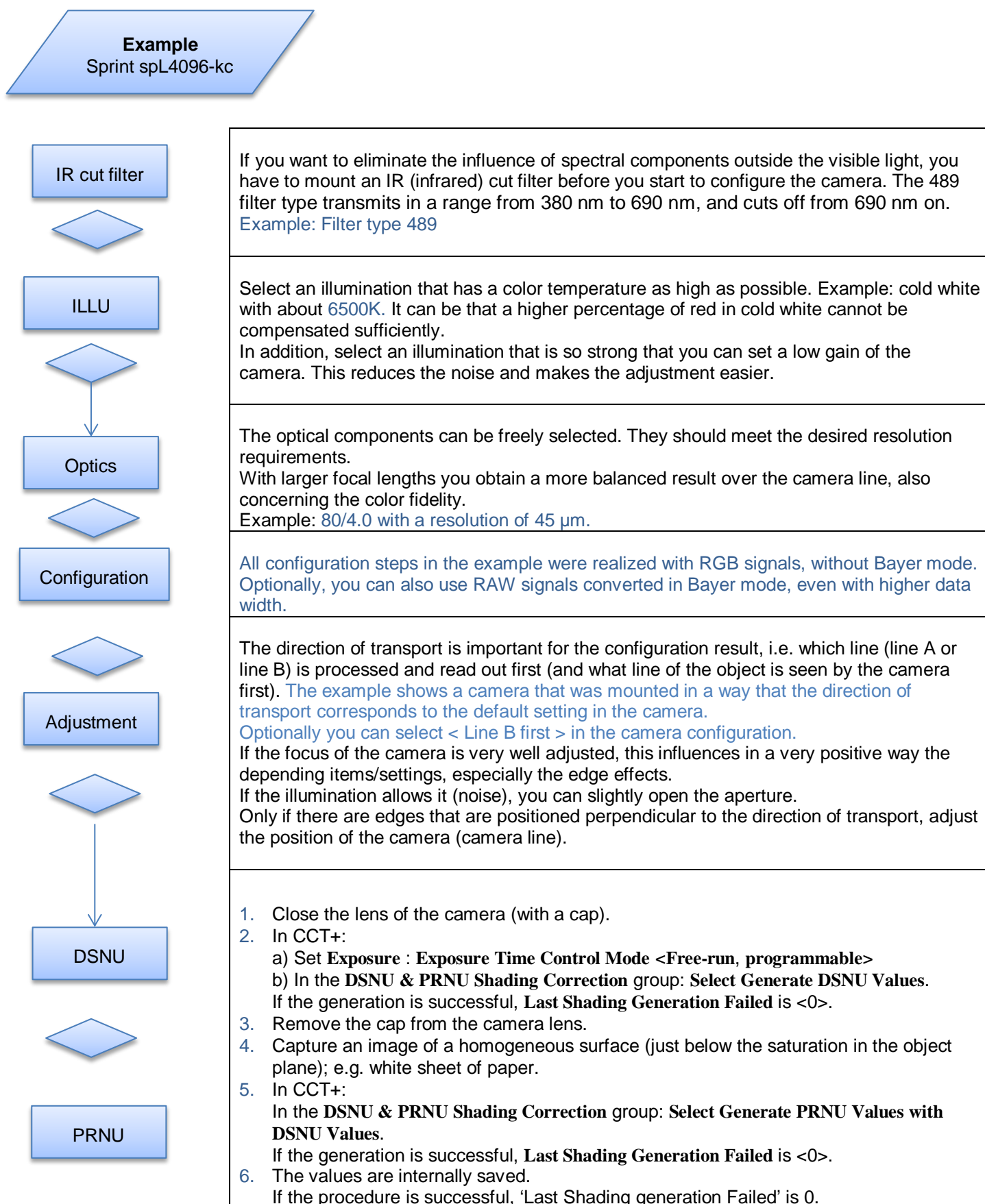
Parameter Name in CCT+	Values Without Correction	Tungsten 2800 K	Daylight 5000 K	Daylight 6500 K
[Color Adjustment]				
Color Adjustment Enable	0	1	1	1
Saturation Red	64	91	69	70
Hue Red	0	8	15	13
Saturation Yellow	64	139	104	104
Hue Yellow	0	18	- 4	- 4
Saturation Green	64	203	152	147
Hue Green	0	127	69	54
Saturation Cyan	64	91	89	91
Hue Cyan	0	115	46	42
Saturation Blue	64	105	89	91
Hue Blue	0	- 24	- 26	-27
Saturation Magenta	64	115	125	117
Hue Magenta	0	127	127	127
[Gain & Offset]				
... Gain Red [dB]	0	1	1	1.0344
... Gain Green [dB] *	3.5	2.1669	1.1499	1
... Gain Blue [dB]	6	6.2717	1.8924	1.513
Offset [DN]	0	0	0	0
Gamma	1	0.416667	0.416667	0.416667
[Lookup Table]				
Lookup Table Enable (i.e. Gamma Enable)	1	1	1	1
* By default Gain Green 2 is disabled. If enabled, the gain value would be as the Gain Green value.				

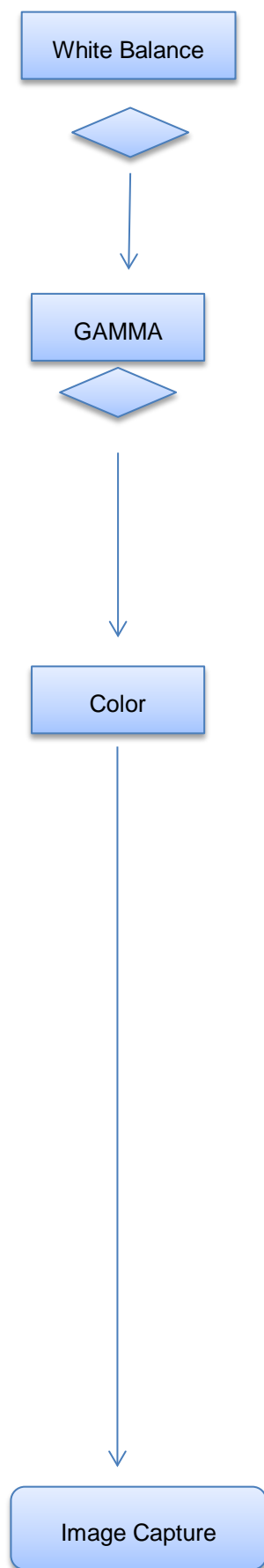
LED light source

As the variety of light emitting diodes is very large, e.g. varying temperature and color ranges etc., no values for an LED light source are indicated in this table.

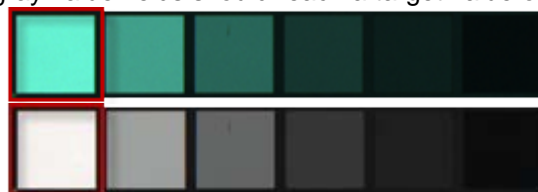
If you want to use an LED, we recommend to check the color and temperature values for the selected LED type and take the values of a light source that is close to the LED color temperature. This can be a starting point for your color enhancement.

Short Overview of 'Sequences of Steps'





The **ColorChecker®** is in the object level. All components of the RGB signal (red, green and blue) in the unsaturated (illumination, gain near the reference value), brightest field of the gray value fields should reach a target value of 242 (the field marked with a red rectangle).



The green gain is slightly modified ($G = 242$); the red gain is set to $R = 242$, and the blue one to $B = 242$.

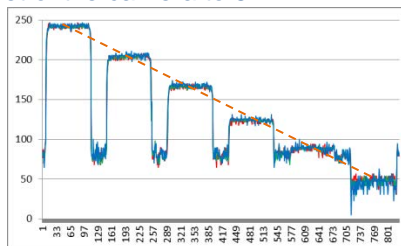
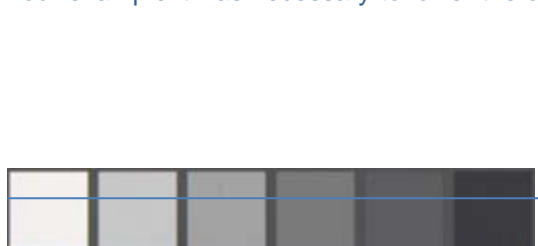
You obtain gray values in the chart where $R = G = B$.

The **ColorChecker®** is in the object level.

The gamma value is set to 0.42. For most applications this should already work.

The target is that the six gray value fields must reach the reference values.

In our example it was necessary to lower the offset of the camera to 5.



The **ColorChecker®** is in the object level.

The color adjustment feature in the sprint camera lets you adjust **hue** and **saturation** for the primary colors (RGB) and the secondary colors (YMC).

The most efficient way to display a live image is to use the **MIL** software.

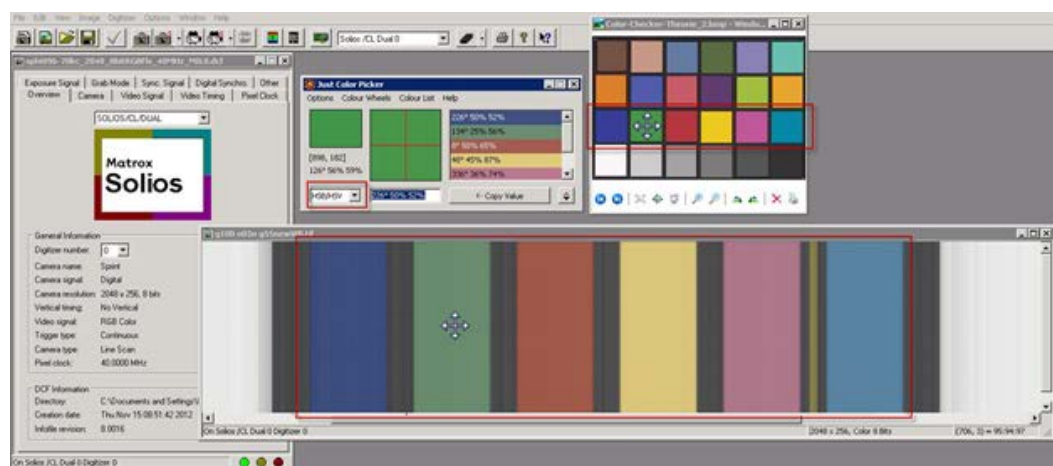
Either the reference image of the Color Checker can be opened as a sample for the ColorPicker or you know the reference values (because you saved them).

191° 95% 63%
323° 54% 73%
50° 87% 91%
357° 69% 69%
122° 53% 58%
237° 63% 59%

Adapt the values of the single colors until you obtain a satisfactory result.

The parameters correspond to the HSB color space. You can set the ColorPicker to the HSB color space.

Neighboring colors will influence each other, e.g. changes for yellow may also slightly change red and green. This is why several adaptation steps are necessary.



Revision History

Document number	Date	Change
AW00120501000	--	First preliminary version only exists in German.
AW00120502000	Jan 14, 2013	First version (02 version in document number, because the English version differs from the original German version no. 01).
AW00120503000	Feb 12, 2013	<ul style="list-style-type: none"> Entered note that "How to Adjust the Camera (Gamma, White Balance, Color Settings)" section is also present in the Basler sprint color user's manual and that it will be there in the newest version. Users should check in the sprint user's manual whether there is a newer/updated version of this section. Inserted link to Matrox website on page 3. Inserted information on what color camera models have the color enhancement feature available on page 11. Inserted information on color enhancement description in Basler sprint color user's manual on page 11.

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