# PRODUCT INSIGHT

## Powerful Features in Basler dart and pulse Cameras

**Basler has equipped its dart and pulse camera series with effective features that are designed to optimize image quality for the human eye. This Product Insight describes the cameras' default settings and their purpose, and explains these features in detail. However, to make the Basler dart and pulse cameras suitable for the widest possible range of vision applications, their feature values can be optimized to also satisfy the image quality requirements of automated vision. This article offers information on where to change settings and which settings should be changed, depending on the use case.**

## Content

## 1. The Default Settings of Basler dart and pulse Cameras

Basler dart and pulse cameras are optimized for human vision. Hence, the cameras' default settings are set to produce best image quality as it is perceived by the human eye. This makes Basler dart and pulse cameras ideal for applications where the images are evaluated by the human eye. The images in such applications are inspected by humans and not – as in factory automation – by a machine. The human eye perceives images differently than a machine vision system. To match the color perception of the human eye, these images are color-optimized by default. These default values and settings – light source preset, gamma value, PGI algorithms – are optimized for medical and retail applications. By contrast, classic machine vision (MV) cameras such as the Basler ace, for example, come with default settings that are optimized for automated vision systems.

To make the Basler dart and pulse cameras suitable for the widest possible range of vision applications, their feature values can also be optimized to meet the image quality requirements of automated vision. For MV applications, these values can be adjusted to optimize the image results for those specific cases.

Cameras in industrial factory or lab automation applications deliver raw images as required by machine vision systems. The data in these images is completely unprocessed, because it will be processed outside the camera in the course of the subsequent, application-specific image analysis. This raw mode can be preset in the default settings, so that the camera features can then fulfill their tasks precisely as required by the specific application.

## 2. New Camera Features

When Basler dart and pulse cameras were developed, some image optimization features were designed directly into the electronics, the FPGA of the camera. These are:

- PGI Feature Set:
  - Denoising
  - Improved Sharpness
  - 5×5 Debayering
  - Color-Anti-Aliasing
- Backlight Compensation
- Anti-Flicker Filtering

## 3. PGI

Basler's new, proprietary PGI feature set is all about image optimization through denoising, improved sharpness, 5×5 debayering and color-anti-aliasing. It produces a significantly higher image quality aligned to human viewing requirements.

Because the PGI feature set is integrated into the camera's FPGA, it is switched on when the camera is started. It can be switched off by changing the camera's settings to RAW-Mode. Changing the pixel format to "BayerGB8", or "BayerGB12" will cause the camera to switch off the PGI image optimization feature set.

Switch to change to a pixel format without PGI (e.g. in Basler pylon Software Suite):
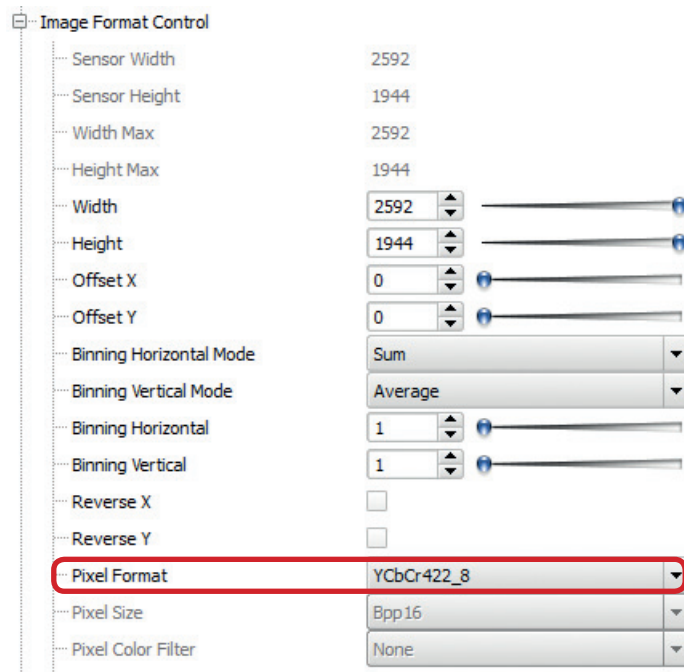


## 3.1 PGI Denoising

Digital noise looks similar to film grain, as we know it from analog film. It frequently occurs in situations with poor lighting. The PGI denoising algorithm reduces the standard deviation significantly, which makes it an effective tool for applications operating under limited light conditions.
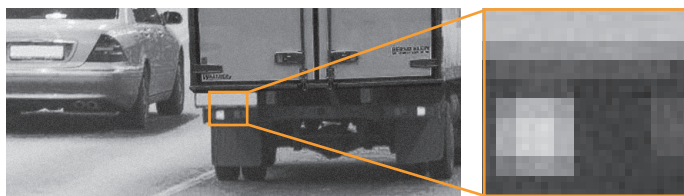


*Classic denoising*



*PGI denoising*

The PGI denoising feature cannot be controlled separately. It is always switched on when the PGI feature set is in operation. If a usage scenario does not profit from this feature, the pixel format must be changed as shown above.
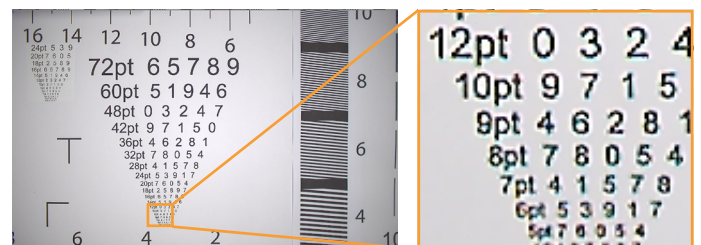
## 3.2 PGI Improved Sharpness

Sharpness is one of the most important image quality factors because it determines the amount of detail an imaging system can reproduce.

The PGI sharpness algorithm, which is integrated into Basler's dart and pulse cameras, makes edges better visible for improved analysis. Additionally, image areas with very fine structures benefit from the increase in contrast.
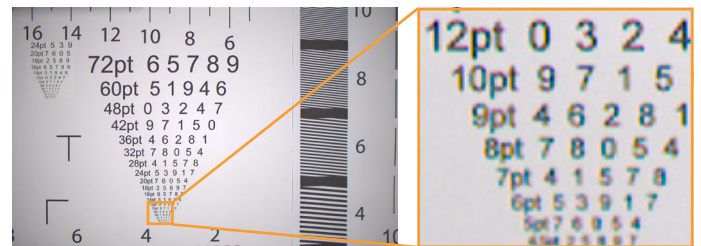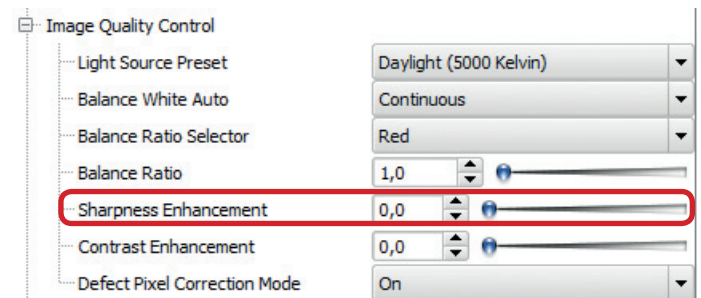


*Without PGI Improved Sharpness*



*With PGI Improved Sharpness*

The precise degree of sharpness can be directly controlled by a separate function, called "Sharpness Enhancement".
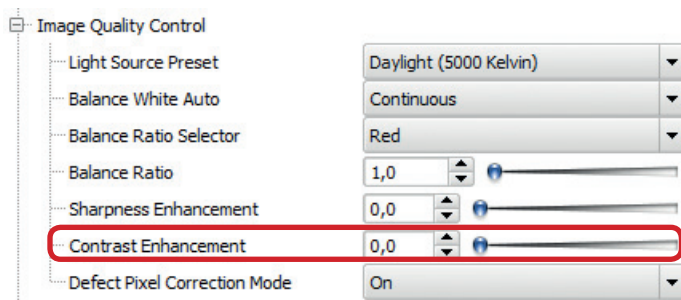
## 3.2.1 Contrast Enhancement

To deliver a more brilliant picture, the dart and pulse cameras are equipped with a contrast enhancement that lets users boost the brilliance in the camera images.



*Contrast enhancement with Basler PGI*

The precise level of contrast enhancement can be controlled directly via the pylon Software Suite or the SDK:



## 3.3 PGI 5×5 Debayering

PGI 5×5 Debayering delivers a higher quality de-mosaicing than in the past. Edges as well as diagonal lines are now reproduced with better image quality. Saw-tooth distortion is significantly reduced. The result is a better image, with fewer artifacts.



*With standard 2×2 debayering, artefacts such as saw-tooth distortion or zip effects compromise the image quality considerably.*



*PGI 5x5 debayering clearly improves the edges in the image.*

As this feature is an integral element of the image pipeline, it is always in operation and cannot be switched off.

## 3.4 PGI Color-Anti-Aliasing

A new anti-aliasing algorithm enhances image details and prevents color blooming, especially in fine structures with high contrast in black-and-white changes. This feature is particularly beneficial for applications where Optical Character Recognition (OCR) is important, such as barcode reading in logistics, or license plate recognition in intelligent traffic systems.
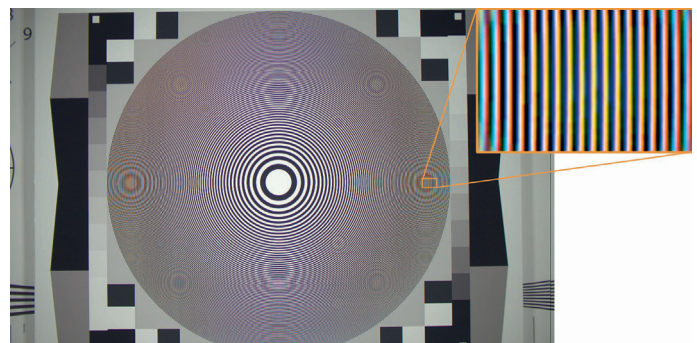


*Standard anti-aliasing produces (orange-blue) aliasing effects.*
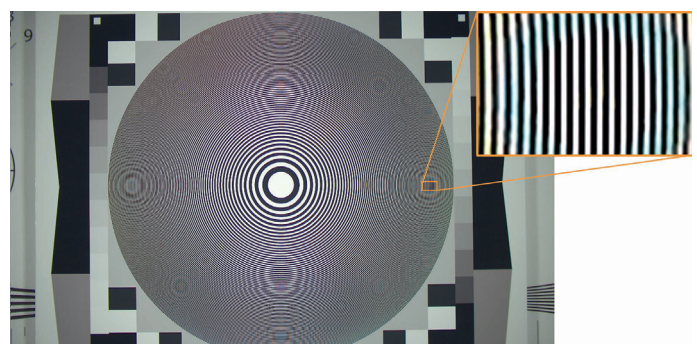


*With PGI color-anti-aliasing, the picture shows accurate and well-defined details.*

The Color-Anti-Aliasing feature cannot be controlled separately. It is always switched on when PGI is in operation.

## 3.5 Switching off the PGI Feature Set

If you need to switch off the PGI feature set, you must change the pixel format setting to another mode, such as "BayerGB8" or "BayerGB12". To permanently store this setting, a user set can be stored. In order to make it a standard setting, override the default user set in the Basler pylon Software Suite or in the SDK.
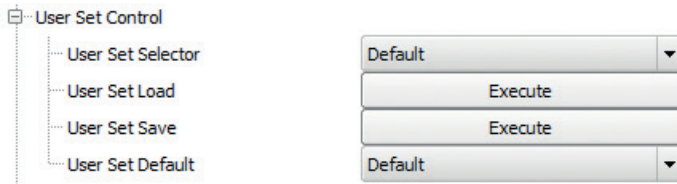


A detailed description of possible default settings, as well as recommendations for working with user sets are available in the *Basler dart* and *Basler pulse user manuals* and in the *Basler pylon SDK*.

## 4. Backlight Compensation

In images where a bright light source is located behind the subject of interest, this subject would normally appear in silhouette. Backlight Compensation allows the camera to adjust the exposure of the entire image to properly expose the subject in the foreground.

The aim of backlight compensation technology is to let the camera find the best image conditions and automatically select the necessary light level compensation.
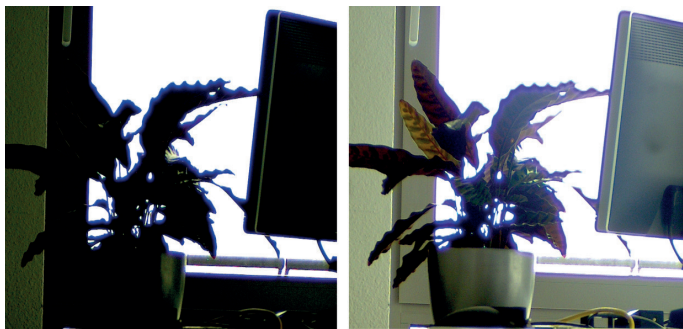


*Without Backlight Compensation*     *With Backlight Compensation*

The compensation of backlight can be controlled directly via the pylon Software Suite or the SDK:



## 5. Anti-Flicker Filtering

Flickering is created when a camera is operated in an environment where light waves are radiated with rates of 50 Hz or 60 Hz. This flickering can cause significant changes from one image to the other. As Basler dart and pulse cameras are mainly operated in an indoor environment, they are equipped with anti-flicker features for 50 Hz and 60 Hz within the framework of their auto-function profiles. Depending on the regional line voltage, the cameras' auto-function profiles can be set to Anti Flicker 50 Hz or Anti Flicker 60 Hz. By adjusting these settings you can considerably reduce the effects of flickering in your images.

The Anti Flicker Filter can be controlled directly via the pylon Software Suite or the SDK:
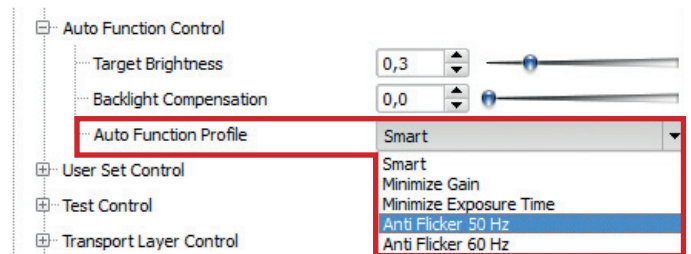




*Without Anti-Flicker*        *With Anti-Flicker*



*Basler dart and pulse*

# PRODUCT INSIGHT

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## Author

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Product Manager

Denis Dettmer is a product manager at Basler AG. He had previously worked in Sales and Marketing for a manufacturer of POS and banking systems and as a product manager for camera-based self-service systems at a large German banking association. His career also included the position as a certified requirements engineer and project manager for an IT outsourcing company.

In his current position, he opens up his understanding of processes and his extensive market expertise to Basler customers around the globe as a resource for information and advice related to board level cameras for the Medical and Life Sciences fields.

Within the company, Denis in his role as product market manager brings customer and technical requirements in terms of board level cameras into harmony with what is feasible at the product management level. This includes responsibility for short-term and future board level camera development for the vertical Medical and Life Sciences market.

## Basler AG

Basler is a leading global manufacturer of digital cameras for industrial and retail applications, medical devices, and traffic systems. Product designs are driven by industry requirements and offer easy integration, compact size, excellent image quality, and a very strong price/performance ratio. Founded in 1988, Basler has more than 25 years of experience in vision technologies. The company employs 500 people at its headquarters in Ahrensburg, Germany, as well as in international subsidiaries and offices in Europe, Asia, and the Americas.

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