

## Explaining the Measurements

**1288**  
EMVA Standard Compliant

Basler Components is a leading company in the push for standardizing the measurement and presentation of machine vision sensor and camera specifications. All measurements done by Basler will be 100% compliant with

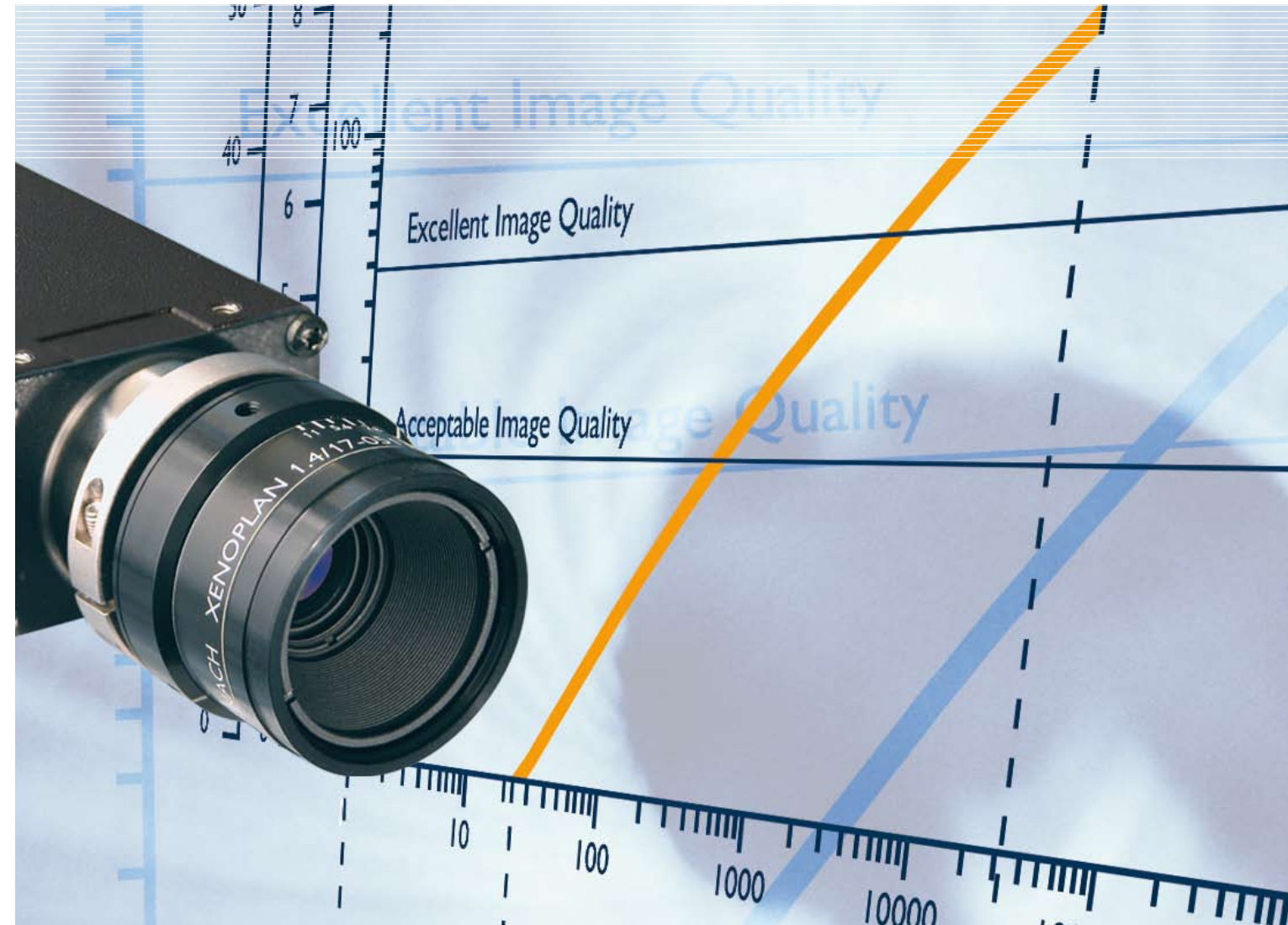
EMVA standard 1288 (Standard for Measurement and Presentation of Specifications for Machine Vision Sensors and Cameras). Basler has given this standard the strongest support. Basler helped to develop the unified method used to measure, compute and present the specification parameters for cameras and image sensors used in machine vision applications.

The EMVA 1288 standard includes a well defined method for measuring most common noise sources. It also includes a mandatory and detailed description of the measurement setup, environmental conditions and test requirements. As a first step, only the standardization process for monochrome area scan cameras is covered. An expansion covering the standards for color area scan and line scan cameras is expected to follow.

The signal-to-noise ratio chart provides information on the image quality and sensitivity for a tested camera. The chart describes the development of the signal-to-noise ratio from a low level where noise overlays the signal, up to the point of saturation. It embeds the relevant camera parameters such as full well, dynamic range and the signal-to-noise ratio for selected values on the curve that are relevant for a specific application.

The EMVA 1288 standard is available at [www.emva.org](http://www.emva.org). A detailed technical whitepaper describing the used measurement methods in the standard can be downloaded from [www.baslerweb.com](http://www.baslerweb.com).

# Basler Sensitivity Data



Reading the Diagram



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## Signal-to-Noise Ratio

The y-axis shows the signal-to-noise ratio in terms of decibels, bits and real numbers. The actual signal-to-noise ratio corresponds to a value on the x-axis that represents the number of photons collected.

## Signal-to-Noise Curve

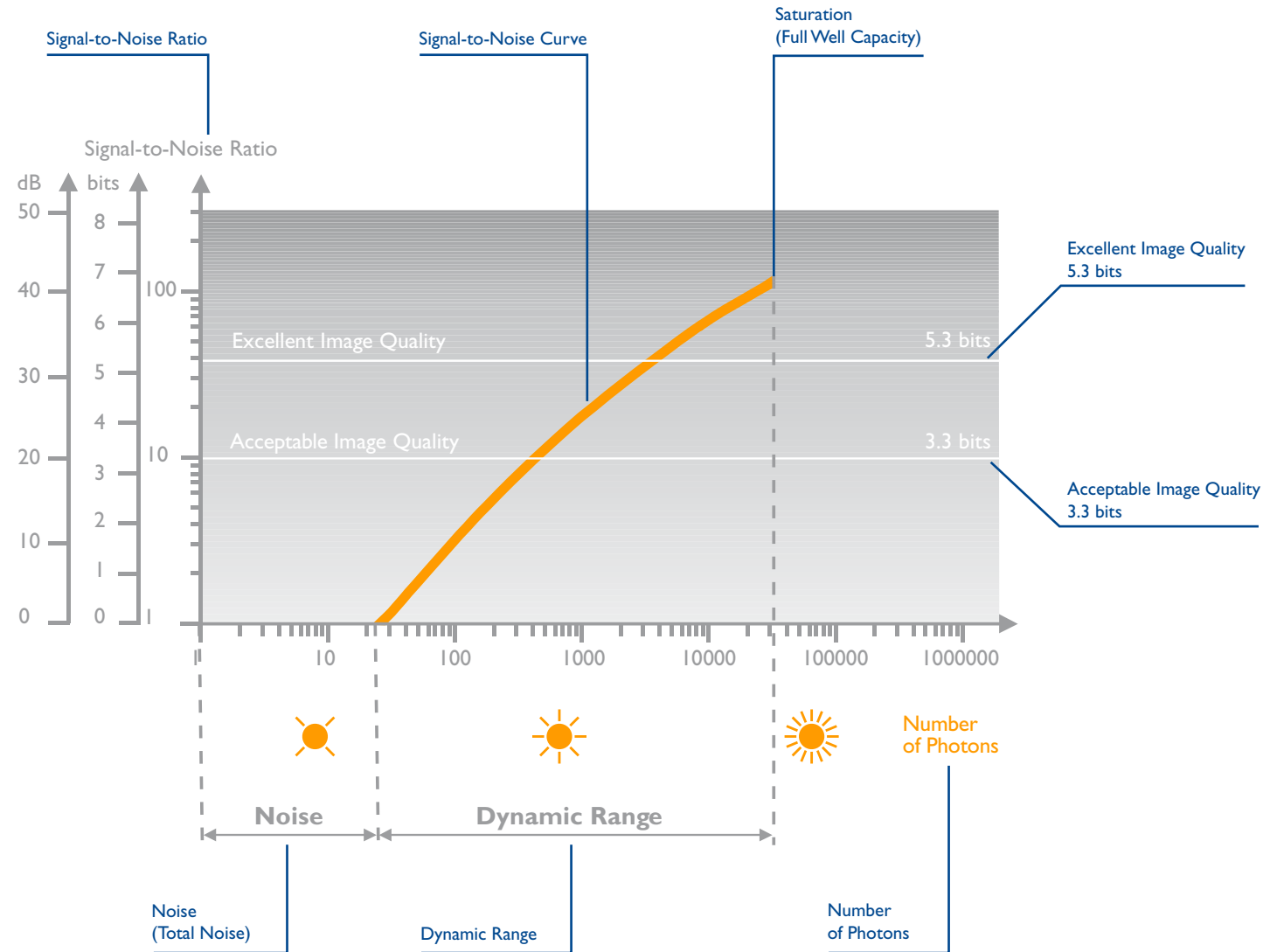
This curve represents the typical development of the signal-to-noise ratio for a given camera as the camera collects photons. If you know the number of photons collected, you can use the chart to determine the typical signal-to-noise ratio and vice versa.

## Noise (Total Noise)

There are three main sources of noise inside of a camera. Dark noise includes all noise sources that are present when the camera lens is completely capped. Dark current noise (temporal) occurs when the camera is operating and is strongly influenced by the temperature. Spatial noise, the non-homogeneity of pixels encountered when getting the first detectable signal, is also covered by the measurements.

## Dynamic Range

Dynamic Range describes the ratio of the largest signal to the smallest signal (that can be distinguished from noise) in an image. This is the ratio of the saturation charge to the detection limit (read out noise). The Dynamic Range affects the quality of an acquired image directly by determining the amount of possible gray values in the image.



## Saturation (Full Well Capacity)

The full well capacity defines the amount of electrons a single pixel can hold before becoming saturated. Limiting the full well capacity, e.g., by using an anti-blooming voltage, can lower the point of saturation.

## Excellent Image Quality

A signal-to-noise ratio higher than this level indicates excellent image quality as defined by the ISO 12232 standard for determining image quality.

## Acceptable Image Quality

A signal-to-noise ratio higher than this level indicates acceptable image quality as defined by the ISO 12232 standard for determining image quality.

## Number of Photons

The x-axis shows the total number of photons hitting a single geometric pixel on the sensor during exposure time at a given wavelength. The chart shows results ranging from a low light exposure to a very bright light exposure. The different light levels are represented on the x-axis.

Example:  
Assume that you are comparing the camera described in the chart with a second camera. Also assume that you are comparing the two cameras at a 5 bit signal-to-noise ratio (SNR). You will find that the camera in the chart requires about 2000 photons to achieve a 5 bit SNR. If the second camera requires 4000 photons to achieve a 5 bit SNR, then it is half as sensitive as the camera described in the chart.