Basler A400 Series
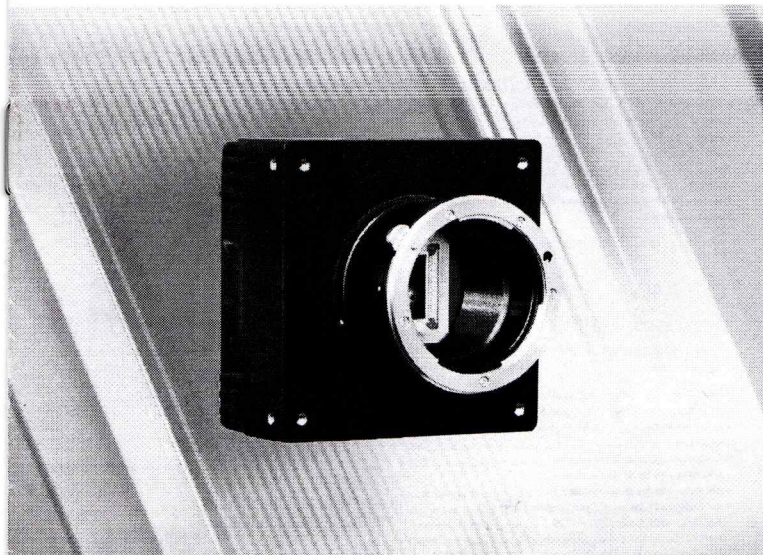
The A400 Area Scan Series

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Introduction

The A400 series was developed with the goal of offering a high performance camera to meet the most stringent requirements in terms of resolution, speed, and image quality. This goal was realized by using a sophisticated four megapixel sensor and a unique camera backend, a combination which provides brilliant image quality and the possibility of fast preprocessing. To ensure reliable, consistent quality, A400 variants are 100% quality checked and calibrated. All of this makes A400 cameras exceptionally flexible and reliable tools for many applications.
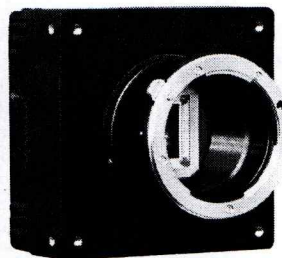
The A400 Series — Experience the Combination of Speed and Quality

All A400 cameras contain a high quality CMOS sensor with 2352 x 1726 active pixels. While the speeds of the most common CCD sensors are limited to 15 fps, A400 variants offer superior maximum frame rates:

- **A402k/kc - 24 fps at full resolution**
- **A403k/kc - 48 fps at full resolution**
- **A404k/kc - 96 fps at full resolution**
- **A405k/kc - 167 fps at 2320 x 1726**
- **A406k/kc - 209 fps at 2320 x 1726**

The A400 family sets a new standard of excellence with performance and image quality that rivals CCD cameras. The extraordinary image quality results from the use of advanced CMOS sensors and sophisticated electronic design. And three different image enhancement features can improve image quality even more:

- **Column shading correction to eliminate fixed pattern noise**
- **DSNU shading correction to eliminate dark signal non-uniformity**
- **PRNU shading correction to eliminate photo response non-uniformity**

The absence of blooming or smear represents another advantage over cameras with CCD sensors. Missing codes are not an issue for the A400 and the images are very homogeneous in this respect. The fast FPGA used in A400 cameras enables the option of onboard preprocessing and allows the implementation of individual algorithms adapted to customer requirements.

Your benefits include:

- ❋ Increased throughput
- ❋ Brilliant image quality even at the highest speeds
- ❋ Easy integration into your application
- ❋ An even better fit via individual customizations
- ❋ 100% quality checked and calibrated to give you consistent performance and reliability

The AOI Feature, AOI Lists, and the AOI Editor

When the area of interest (AOI) feature on an A400 camera is used, only a designated portion of the image will be transmitted out of the camera. This reduces the amount of data transmitted by the camera and increases the maximum allowed frame rate.

On A400 cameras, a set of individual AOIs can be defined in an AOI list. Each individual AOI can have different parameter settings such as AOI position, AOI dimensions, exposure time, and flash activation. The resulting sets of AOI parameters can be saved in the camera and executed internally. This means that the slow serial communication port is not needed to change from one set of AOI parameters to another and this allows higher frame rates during operation.

The AOI editor software tool makes creating an AOI list simple. With this easy-to-use tool, each AOI in the list is created in a graphical way by using a captured image to position the AOI in the most interesting region and to adjust its size. The AOI list is automatically created, and it gives an overview of the positions, sizes, exposure times, delay times, and flash activation for each AOI in the list. The program highlights any incorrect settings and provides the information needed to make corrections.
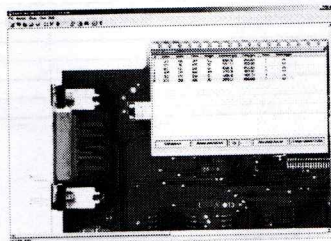
Applications

A400 cameras are particularly useful in applications such as PCB inspection where the AOI feature is often used. Bare board inspection and flat panel display inspection are also applications where the A400's superior image quality and high speed are both required. Wafer inspection, bonding inspection, die placement, and packaging are all typical applications in the semiconductor market. Other applications include 3D measurement, document processing, and postal and document sorting.

Camera Link® Interface

Camera Link is a communication link for visual applications in the fields of science and industry.

Camera Link was founded in the year 2000 by Basler and other leading companies in the machine vision arena.

Standard Camera Link enables a maximum data transmission rate of 680 MB per second depending on the configuration.

Frame grabbers which collect and evaluate the data are usually used to connect the camera and the PC via the Camera Link interface.

The most important benefits afforded by Camera Link are:
- **Accepted communication standard for vision technologies (camera frame grabber)**
- **Simple and standardized cable concept**
- **Particular suitability for high data rates**
- **Standardized data protocol for several types of date transfer, for example single/dual tap, 8 bit, 10 bit, RGB, etc.**
- **Serial communication to the camera via the frame grabber communication port**

The standard CameraLink interface used on the A400 family makes these cameras compatible with frame grabbers produced by many different vendors. These vendors include: Cognex, Matrox, National Instruments, Euresys, Matrix Vision, BitFlow, Mikrotron and Lynx. An overview showing more frame grabber vendors and frame grabbers compatible with A400 series cameras can be found on the Basler webpage at www.baslerweb.com.

TECHNICAL DETAILS

Specifications

Basler A400 Series	A402k/kc	A403k/kc	A404k/kc	A405k/kc*	A406k/kc
Camera					
Sensor Size (H x V pixels)	2352 x 1726	2352 x 1726	2352 x 1726	2320 x 1726	2320 x 1726
Sensor Type			Progressive Scan CMOS		
Optical Size			1 1/4"		
Pixel Size			7 µm x 7 µm		
Camera Link Clock	50 MHz	50 MHz	50 MHz	85 MHz	85 MHz
Max. Frame Rate (at full resolution)	24 fps	48 fps	96 fps	167 fps	209 fps
Color / Mono			Color / Mono		
Video Output Type	Camera Link (Base)	Camera Link (Medium)	Camera Link (Full)	Camera Link (Full)	Camera Link (10 tap)
Video Output Format	2 taps, 8 bits/10 bits	4 taps, 8 bits/10 bits	8 taps, 8 bits (@ 96 fps) 4 taps, 8 bits/ 10 bits (@ 48 fps)	8 taps, 8 bits 8 taps, 10 bits**	10 taps, 8 bits
Synchronization			Via external trigger or free-run		
Exposure Control			Level-controlled, or programmable		
Power Requirements	12 VDC (±10%) Max. 8.0 W	12 VDC (±10%) Max. 8.5 W	12 VDC (±10%) Max. 9.0 W	12 VDC (±10%) Max. 11.0 W	12 VDC (±10%) Max. 13.0 W
Mechanical / Electrical					
Lens Mount			F-mount		
Housing Size (L x W x H)			42 mm x 90 mm x 90 mm (without lens adapter)		
Weight	Max. 605 g	Max. 615 g	Max. 615 g	Max. 615 g	Max. 615 g
Conformity			CE, FCC		
Housing Temperature			Up to 50° C		

Specifications may change without prior notice. * Available Q4/2009. ** Camera Link (10 tap)

For detailed technical information, please see the camera manual that can be found on our website: www.baslerweb.com/manuals

Dimensions (in mm)
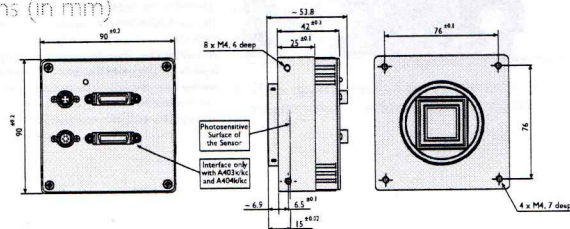
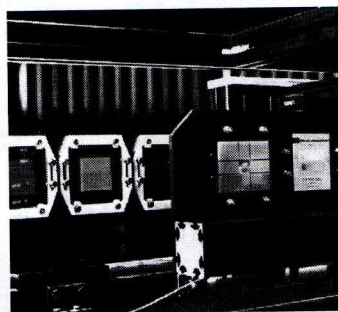## What Makes Basler Camera Quality so Special?

To ensure consistently high product quality, we employ several quality inspection procedures during manufacturing. The following list describes some of the most essential actions we take to meet your highest requirements:

- The back focal length on each camera is carefully measured and adjusted. This guarantees an optimum distance between the lens flange and the sensor and ensures compliance with optics standards.
- Our advanced Camera Test Tool (CTT+), the first fully-automated inspection system for digital cameras, checks all of the significant quality aspects of each camera we produce. The CTT+ is a unique combination of optics, hardware, and software that can be quickly and efficiently used to calibrate a camera and to measure its performance against a set of standards. For defined sets of conditions, an automated software program examines the camera's output, makes any calibration adjustments necessary, and compares the output to a strictly defined set of performance criteria.

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