EMBEDDED VISION

- Basler cameras and camera modules – the power of sight for embedded vision applications

- Plug and play evaluation and development kits

- Up to 3-year warranty, long-term availability

- Easy integration into embedded systems

- Highest stability and flexibility thanks to machine vision standards

- Leanest and most cost-effective solutions

- Worldwide service and support

BASLER
the power of sight

WHY BASLER CAMERAS?

PRISTINE PICTURES, PERFECT COLORS

Outstanding mage quality

- True colors, clear contrasts, high resolution, fast live images
- Best-in-class image pre-processing like debayering, denoising, improved sharpness, and more
- Detailed pictures creating the optimal basis for computed vision data

YOUR PARTNER FOR OPTIMUM DESIGN-IN PHASE

Easy system integration

- Easy integration with SDK working on most common platforms with identical API
- Easy plug and play interfaces and embedded interfaces for the leanest systems
- Openly documented and well-defined interfaces and software protocols
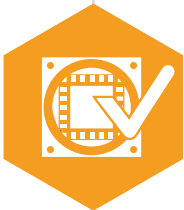
SELECTING YOUR PERFECT CAMERA MODULE

High quality at low cost

- Real-time video and high resolution for monitoring, inspection, and recognition
- Compact housings or board level variants for easy design-in
- Perfect camera-internal or host-side image preprocessing

PURCHASE DECISION WITH MINIMUM RISK

Secure future investment

- Long-lasting camera module life and reliability
- Long-term product availability
- Long-term support for operating systems

CARE-FREE CAMERA MODULE LIFE CYCLE

Comprehensive support and services

- Up to 3-year warranty on our camera module portfolio
- Service on demand by Basler's technical support
- Point of contact at your site via Basler's worldwide network of offices

DEFINING YOUR SYSTEM REQUIREMENTS

Supported by experts

- Technology leadership with 30 years of vision experience
- Key driver of technology trends and vision standards
- Basler's position as most trusted brand in industrial digital cameras

Go Embedded with Basler

Combining embedded design and vision technology is a rising trend, but it requires knowledge and resources. We at Basler understand the challenges along the way to an optimal embedded vision system. That's why Basler offers a broad portfolio of camera modules and components for embedded systems as well as various tools and sources of support.

As a vision technology expert, Basler provides high quality products that can easily be integrated into embedded vision systems. For camera connection, you can choose between standard USB and GigE interfaces and board-to-board connection with Basler's BCON interfaces for MIPI CSI-2 or LVDS. They all work together with Basler's comprehensive pylon Camera Software Suite with its SDK (software development kit) running on several platforms. With pylon's proven and unified API (offering a standard Application Programming Interface for all operating systems and all camera interfaces), you can easily access all camera features. Furthermore, Basler's evaluation and development kits serve as a helpful tool during the design-in phase.

Basler ensures the best image quality, the highest system reliability and a low processor load with the technological maturity of Basler camera modules, as well as through stable data transfer and in-camera image pre-processing and the perfect utilization of host-side Image Signal Processors. Thus, you can trust in Basler cameras and camera modules to deliver maximum performance and superior images so that you are free to focus on your main target: optimizing your product and making your application a success – with Basler and embedded vision technology.
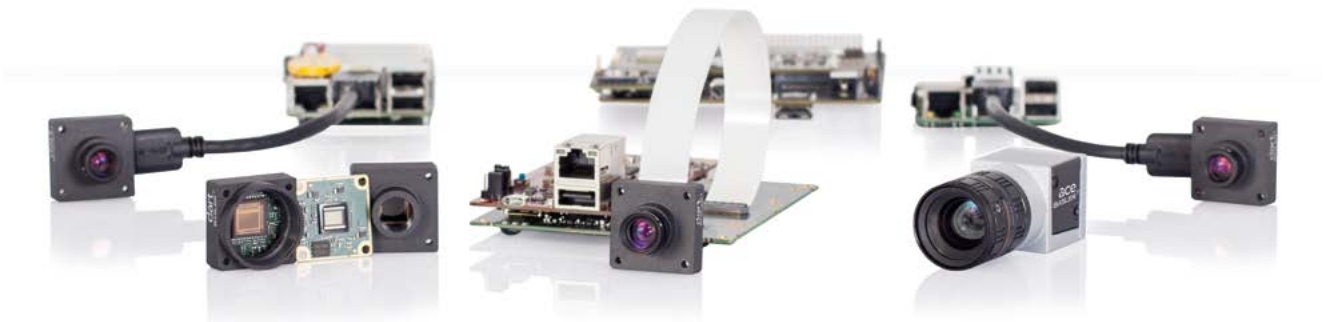
What Is Embedded Vision?

So-called embedded systems are becoming more and more popular for an increasing range of products. This is a result of constant development in the semiconductor and IT technologies. Today SoCs (system on chip) are the central element in an embedded design. They are used on popular off-the-shelf single-board computers just as in versatile off-the-shelf processing modules (SOM, system on module or COM, computer on module) or even on fully custom designed boards, which allow for a wide variety of new applications.

Simultaneously, industrial Machine Vision technology is evolving towards smaller and more cost-effective cameras with consistent image performance.

The combination of these two technological developments creates "embedded vision", utilizing the powerful opportunities of vision-based technology in small and highly optimized products – creating simple embedded solutions.

As a result, vision products can become leaner and cheaper: Typical examples of this are handheld medical examination devices, compact inspection tools or smart recognition equipment. Furthermore, completely new products can now be developed economically and make our lives more convenient, smarter, and more secure.

Factory Automation

Industrial applications are the traditional field of Machine Vision and they are an essential part of production and processing. By utilizing embedded vision in your industrial application you can benefit from:

- Simplification of existing vision solutions in order to reduce system costs

- Modularization of inspection or control units so that they can be used in different products of the portfolio. This can decrease development costs and increase serviceability.

- Miniaturization of inspection systems, either for a smaller complete system or due to space constraints, e. g. for in-machine inspection

- Mobility of tools, such as inspection or measurement devices which need to be portable

- Technical opportunities made possible by autonomous mobile or moving machines and robots

- Applications of Industrial Internet of Things (IIoT) or Industry 4.0 for extensive inter-machine communication and smart factory automation

With 30 years of vision expertise and a dedicated embedded portfolio, Basler will support you in taking your industrial application to the next level.

POSSIBLE APPLICATIONS

Inspection
- Web inspection
- Modules for independent machine inspection
- AOI (automatic optical inspection) with small space requirements
- Item counting
- Mobile test equipment

Logistics
- Shelf robots for logistics
- Automated guided vehicles (AGV) for transportation
- Code/text readers
- Determination of position and dimensions of an object

Robotics
- Mobile robots (transportation/security)
- Robot arm top-camera for process control or working range surveillance
- Lightweight camera on a robot arm gripper
- Pick-and-place applications

Industrial Internet of Things (IIoT)
- Control, guidance, and machine status survey units
- Smart industrial wearables
- Intelligent surveillance/safety equipment

TYPICAL APPLICATIONS

Medical & Life Sciences

The health care and life sciences sector is being deeply transformed by a variety of new requirements and calls for new approaches in technology design. Embedded vision helps medical device manufacturers achieve the right combination of high performance, low cost, low power, and programmability to meet current trends such as:

- Point-of-care-testing: Diagnostic devices are evolving towards the patient's home environment, becoming more portable, flexible, and personalized.

- Miniaturization: While devices are getting smaller, the demand for reproducibility and accuracy is growing.

- Reduction of costs: Even with growing technical requirements, pressure to control or reduce costs is also rising.

- Growing need: Emerging markets in China, India, Brazil, and the Middle East, as well as rapidly aging population present significant growth opportunities.

These factors will make embedded vision an indispensable key technology for the health sector for many years to come. With a broad range of embedded vision products and extensive experience in industrial camera design, Basler is helping make innovative medical devices more robust, reliable, flexible, and cost effective.

### POSSIBLE APPLICATIONS

Ophthalmology
- Retinal cameras
- Autorefractors
- Optical coherence tomography (OCT)
- Non-contact tonometers
- Digital slit lamp cameras
- Specular microscopes

Lab Automation
- Gel-documentation
- Hematology testing
- Automated cell & colony counting
- Live cell imaging
- Multiplate readers

Others
- Digital dermatoscopes
- Dental scanners
- Remote surgical systems
- Surgical microscopes
- Face skin analysis
- 3D body diagnostics
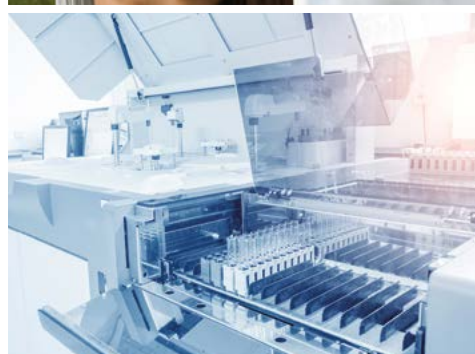
TYPICAL APPLICATIONS

Traffic, Retail & Consumer Applications

Traffic and transportation, retail and consumer appli- cations touch all our lives every day, whether it is number plate or face recognition, the Internet of Things or home automation. Embedded vision simplifies those applications and offers advantages such as:

- Mobility: Products in traffic used for monitoring, control, and enforcement can be installed on car roofs or be hand carried. Also for other monito- ring and control tasks, mobile devices can replace static systems.

- Energy consumption: Due to significantly lowe- red energy consumption by vision and proces- sing system, new technological solutions can be developed.

- Independence: In retail applications, small modu- les can be positioned discretely and work self-suf- ficiently.

- Data protection: Given the strict data protection laws for personal data (license plates, faces) in many countries, camera images must be proces- sed directly after acquisition. This includes en- cryption, comparison, and deletion, which can be ideally performed by an embedded system.

Embedded technology opens up additional mar- kets and enables vision in whole new applications. By bringing this technology into devices that we encounter every day, Basler aims to make our lives easier, safer and more comfortable.

POSSIBLE APPLICATIONS

Traffic & Transportation
- Automatic number plate recognition (ANPR)
- Speed enforcement equipment
- Tolling & traffic management
- Automated parking systems and billing
- Mobile monitoring & surveillance
- Geographical information systems (GIS), e. g. for agriculture

Retail
- In-store automation
- Vending machines/kiosk systems
- People counting, tracking & profiling
- Face recognition (gate control)
- Check-out systems

Consumer applications
- Internet of Things (IoT)
- Home automation
- Smart wearables
- Professional maker applications
- Privately used control, guidance, and security applications

Supported by Experts

Apart from Basler's own reliable Support Team helping you on various camera and integration aspects, Basler has set up new ways to support you during development of your embedded vision system.

Initial setup of an embedded vision system can be complex and expensive, requiring expert knowledge in embedded hardware and software technology and system integration.

Therefore, Basler has founded the Basler Partner Network to connect companies specializing in hardware,

software, technology topics, and integration services to deliver embedded vision solutions for a variety of applications and markets.

The Basler Partner Network combines different areas of expertise, making the design flow as lean as possible and to provide for smooth and efficient system integration – offering you complete and affordable embedded vision solutions.

To learn more about Basler's Partner Network please visit: *www.baslerweb.com/partnernetwork*

imaging hub
Get Vision on Board

One Step Further: Online Developer Community

If you are already in your project's design phase, and looking for solutions, inspiration, and support during development, Imaginghub might just do the trick: Imaginghub is a web-based collaboration and information portal, where engineers meet to work on joint embedded vision projects and share their knowledge and reference designs.

As a an online community platform, Imaginghub aims to facilitate mutual exchange of design experiences and thus reduce integration efforts on the way to cost-effective embedded vision solutions.

At Imaginghub you can:

- connect with other engineers, developers, professional makers, and manufacturers from all over the world
- exchange ideas with others, discuss applications, and work together to find the best solution for your embedded vision project
- search for reference designs and application examples
- find technology or integration partners in the partners gallery

Learn more and join the community on *www.imaginghub.com*

Imaginghub is powered by Basler.

Always the Right Choice for Your Embedded Vision Application

Embedded vision is the technology of choice for a wide variety of applications – and the design require-ments are equally varied. Whatever the specifica-tions regarding your application, Basler fulfills them with a broad range of cameras with different sensors, resolutions, and interfaces.

Basler offers three camera interface technologies for embedded vision systems:

- **USB3 Vision** for easiest integration

- **BCON for LVDS** which is ideal for FPGA based system designs and

- **BCON for MIPI** tailor-made for systems with MIPI CSI-2 connections

All of them work with the same Basler pylon SDK which facilitates switching from one interface tech-nology to another.

USB3 Vision

USB 3.0 is the perfect interface for easy plug and play camera connec-tion, and ideal for camera connec-tion to single-board computers. With the comprehensive pylon SDK, you get access to the camera (i. e., to images and settings) within seconds since USB 3.0 camera modules are standard-compli-ant and GenICam compatible.

Main benefits:

- Easy connection to single-board computers with USB 2.0 or USB 3.0 connector

- Field-proven solutions with Raspberry Pi, NVIDIA Jetson TK1 and many other systems

- Profitable solutions for SoMs with associated base boards

- Stable data transfer with a bandwidth of up to 350 MB/s
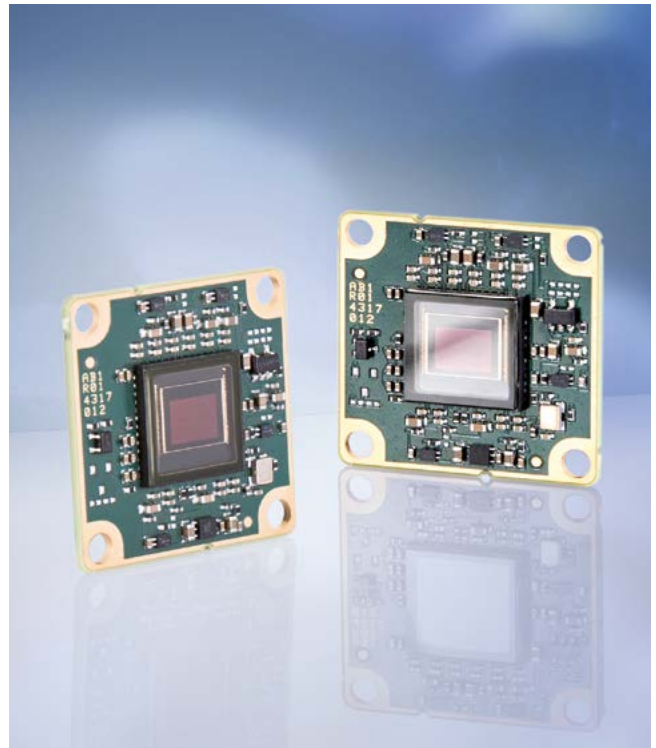
Basler BCON

BCON embodies the conflation of embedded interface tech-nologies such as LVDS or MIPI CSI-2 with Machine Vision features and technology standards like GenICam. Thanks to this perfect liaison between the two worlds and the pylon Camera Soft-ware Suite, BCON offers an unmatched ease of use for camera integration into lean embedded architectures.

Both BCON related interfaces, BCON for LVDS and BCON for MIPI combine all necessary signals for cam-era module operation in one single interface. BCON is designed with a 28-pin ZIF connector for flat flex cables. It contains the 5 V power supply together with LVDS (BCON for LVDS) or D-PHY (BCON for MIPI) lanes for image data transfer, camera I/O e.g. for image triggering as well as an I^2C or CCI bus connec-tion respectively for camera configuration.

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BCON for LVDS

As its name indicates BCON for LVDS is an LVDS-based interface that allows for direct camera connection to process-ing boards and thus to on-board-logic devices like FPGAs (Field Programmable Gate Arrays) or compa-rable components.

This feature enables lean system setup and you ben-efit from direct data access without overhead and full flexibility of FPGA based processing.

Thus, this interface is ideal for connecting the camera to a SOM with a carrier/adapter board or to an indi-vidually designed processing unit. If this processing unit is FPGA-based, you can fully use its advantages with the BCON for LVDS interface.

Basler's pylon SDK is tailored to work with the BCON for LVDS interface. Thus, you can change settings such as exposure control, gain, and image proper-ties via your software code, utilizing pylon's API. The image-grabbing part of the application must be implemented separately as it depends on the hard-ware actually used.

Main benefits:
- Direct camera-to-processor connection for data access without overhead
- Fully GenICam compatible
- Significantly reduced integration effort: With pylon SDK, camera configuration is possible without further programming (via I^2C bus).
- Straightforward camera integration: image data software protocol is openly and com-prehensively documented
- Development kit with reference implementa-tion available
- Flexible flat flex cable and small connector for applications with the highest space cons-traints
- Stable, reliable data transfer with high band-width

BCON for MIPI

BCON for MIPI uses the MIPI CSI-2 standard for image data transmission via D-PHY and for camera configuration via CCI (Camera Control Interface) protocol. This guarantees reliable and stable data transfer with high data rates up to 750 MB/s and makes this technology the tai-lor-made interface for embedded vision applications.

Originally developed to connect smartphone camera modules to mobile processors, Basler adds the needed Machine Vision features and integrates the complex MIPI technology into the world of Machine Vision standards (GenICam). Along with the Basler Driver Package and the pylon Camera Software Suite the users experience an unmatched ease of use: pylon on BCON for MIPI provides the same level of convenience as for any non-embedded camera interface (e.g. USB3 Vision, GigE Vision).

Main benefits:
- Direct camera-to-processor connection over MIPI CSI-2 for data transfer and camera con-figuration without any overhead.
- Best price-performance ratio due to cost optimized design.
- Fast and easy camera integration into the actual user application with only a few lines of code using the pylon SDK.
- Easy code migration thanks to GenICam compliance and thanks to the unified pylon SDK.
- Development kit with reference implementa-tion available
- Flexible flat flex cable and small connector for applications with the highest space cons-traints
- Stable, reliable data transfer with a band-width of up to 750 MB/s

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Camera Modules for Embedded Vision Applications

Whatever your vision requirements are, you will benefit from Basler's extensive experience in camera design and Basler's proven ace and dart camera series, when creating your embedded vision application. The versatile Basler ace camera is equipped with a rugged housing for industry environments, and is available with USB 3.0 or GigE interface. For even smaller embedded vision systems, the Basler dart is your best option. It is a compact board level camera module with USB 3.0 or the BCON interfaces (LVDS or MIPI CSI-2). Both camera series come with highly sophisticated image pre-processing and optimization:

- inside the camera for maximum flexibility and independence form the targeted host system

- or by using the host side ISP for leanest set up and highest cost efficiency

Basler's image pre-processing includes features such as debayering, denoising, and improved sharpness. These optimized images do not require any further polishing, resulting in less software processing and thus lowering the overall processor load.

As with all Basler cameras, you can rely on:

- High camera quality – every Basler camera is tested individually

- Excellent image quality

- Stable, error-free images instead of raw, untreated sensor output

- Easy camera configuration and image capture: Universal pylon Camera Software Suite with SDK for all interfaces

- Stable and reliable data transfer

Camera Highlights

Basler dart
Small board level camera for all needs

- Standard USB 3.0 or BCON for LVDS interfaces for flexible system integration with camera-internal image pre-processing

- BCON for MIPI for cost-efficient design for Qualcomm based target systems

- Bare board, S- and CS-mount options

- Global and rolling shutter options

- Same camera functionality for USB and BCON models – easy evaluation of BCON models using USB version

Basler ace
Ultra flexible camera for highest demands

- Standard USB 3.0 and GigE interfaces

- Over 120 models available

- Highest frame rates, resolutions, and sensitivity

- Latest Sony Pregius and STARVIS IMX sensors integrated

- One of the world's best-selling industrial cameras

- Camera-internal image pre-processing

Specifications Basler dart

USB3 VISION · BCON for LVDS · BCON for MIPI

Basler dart	Sensor	Resolution (MP, H × V pixels)	Frame Rate [fps], Mono/Color	Interface	Pixel Size [µm²]	Sensor Size [mm²]	Optical Size	Shutter Technology
daA1280-54um/uc	AR0134 CMOS	1.3 MP, 1280 × 960	54, m/c	USB 3.0	3.75 × 3.75	4.80 × 3.60	1/3"	Global shutter
daA1280-54lm/lc	AR0134 CMOS	1.3 MP, 1280 × 960	54, m/c	BCON for LVDS	3.75 × 3.75	4.80 × 3.60	1/3"	Global shutter
daA1600-60um/uc	EV76C570 CMOS	2 MP, 1600 × 1200	60, m/c	USB 3.0	4.5 × 4.5	7.20 × 5.40	1/1.8"	Global shutter
daA1600-60lm/lc	EV76C570 CMOS	2 MP, 1600 × 1200	60, m/c	BCON for LVDS	4.5 × 4.5	7.20 × 5.40	1/1.8"	Global shutter
daA1920-15um	MT9P031 CMOS	2 MP, 1920 × 1080	15, m	USB 3.0	2.2 × 2.2	4.22 × 2.38	1/3.7"	Rolling shutter
daA1920-30um/uc	MT9P031 CMOS	2 MP, 1920 × 1080	30, m/c	USB 3.0	2.2 × 2.2	4.22 × 2.38	1/3.7"	Rolling shutter
daA2500-14um/uc	MT9P031 CMOS	5 MP, 2592 × 1944	14, m/c	USB 3.0	2.2 × 2.2	5.70 × 4.28	1/2.5"	Rolling shutter
daA2500-14lm/lc	MT9P031 CMOS	5 MP, 2592 × 1944	14, m/c	BCON for LVDS	2.2 × 2.2	5.70 × 4.28	1/2.5"	Rolling shutter
daA2500-60mm/mc	AR0521 CMOS	5 MP, 2592 × 1944	60, m/c	BCON for MIPI	2.2 × 2.2	5.70 × 4.30	1/2.5"	Rolling shutter

All dart cameras are available with S-mount or as a bare board variant without a lens mount. USB and BCON for LVDS Variants are also available with CS-mount. Current consumption max. 260 mA.

dart MIPI modules are available with two different feature sets. The basic feature set is dedicated to serve use cases related to monitoring and image analysis only, the advanced feature set comes with a handful of additional machine vision oriented features that perfectly address typical automation and metering application scenarios. To learn more please visit: *www.baslerweb.com/dart*

Specifications are subject to change without prior notice.
Latest specifications and availability can be found on our *website www.baslerweb.com/dart*. Please visit *www.baslerweb.com/manuals* for the detailed camera User's Manual and *www.baslerweb.com/thirdparty* for information on third party software.

Specifications Basler ace

USB3 VISION · GigE VISION

Basler ace series with CMOS sensors	Benefits	Resolution (H × V pixels)	Frame Rate [fps]	Interface	Pixel Size [µm²]	Shutter Technology
ace with PYTHON sensors from ON Semiconductor	Highest speed, excellent price/performance ratio	VGA – 5 MP	Up to 750	USB 3.0, GigE	4.80 × 4.80	Global shutter
ace with CMOSIS sensors	High speed, NIR enhancement options, big pixel size	2 MP, 4 MP	Up to 165	USB 3.0, GigE	5.50 × 5.50	Global shutter
ace with SONY Pregius and STARVIS IMX sensors	Outstanding image quality, high speed for demanding applications	2.3 MP – 5 MP	Up to 164	USB 3.0, GigE	5.86 × 5.86 3.45 × 3.45	Global shutter
ace with MT sensors from ON Semiconductor	Highest resolutions	2 MP – 14 MP	Up to 25	USB 3.0, GigE	2.2 × 2.2 1.67 × 1.67 1.4 × 1.4	Rolling shutter

Specifications are subject to change without prior notice.
Latest specifications and availability can be found on our website *www.baslerweb.com/ace*. Please visit *www.baslerweb.com/manuals* for the detailed camera User's Manual and *www.baslerweb.com/thirdparty* for information on third party software.

EMBEDDED VISION KITS

All-in-one Kits for Easy Development

Get acquainted with the dart series:

Basler's Embedded Vision Kits provide developers with an easy-to-use kit with all components needed to evaluate a Basler dart camera with a USB 3.0, BCON for MIPI or BCON for LVDS interface and for hassle-free camera integration.

You can choose from three Embedded Vision Kits:

- a plug and play evaluation kit with a dart USB camera,

- a development kit including a dart BCON camera module with a BCON for LVDS interface and a suitable processing board with a ZYNQ SoC by Xilinx.

- a development kit including a dart BCON camera module with a BCON for MIPI interface and an Arrow DragonBoard 820 equipped with a Qualcomm Snapdragon 820 SoC.

All kits come with additional components such as a lens, cables, and the pylon Camera Software Suite.

Basler Embedded Vision Kits

dart USB Evaluation Kit

- Plug and play evaluation kit with a Basler dart USB camera

- Get familiar with the software connection, camera properties and configuration

- Evaluate the camera's optical performance; also useful if you are planning an embedded vision solution with a dart BCON camera

- Develop software application code for subsequent use on other systems or interfaces

dart BCON for LVDS Development Kit

- Development kit with a Basler dart BCON camera and a processing board for easy integration

- Reference design including camera connection to pylon SDK and code examples for easier development, adaptation, and testing

- Same camera functionality for USB and BCON models – easy evaluation of BCON models using USB version

- Sample carrier board design

dart BCON for MIPI Development Kit

- Development kit with a Basler dart MIPI camera and an Arrow DragonBoard 820

- Ready to go with BSP, Driver Package and pylon already installed

- Plug and play operation of dart MIPI camera module

- Suitable for sophisticated applications due to high performance Snapdragon SoC

- Sample mezzanine board design

Specifications

Embedded Vision Kits	dart USB Evaluation Kit	dart BCON for LVDS Development Kit
Components		
Scope of Delivery	Camera, lens, USB 3.0 cable	Camera, lens, processing board, carrier card, power supply. cables (USB, FFC, Ethernet) and accessories
Camera		
Camera Model	daA2500-14uc	daA2500-14lc
Resolution (H×V pixels)	2592×1944	
Sensor	Aptina MT9P031, 1/2.5″, CMOS, rolling shutter	
Pixel Size [µm^2]	2.2×2.2	
Frame Rate [fps]	14	
Mono / Color	Color	
Video Output Format	Mono (8, 12), YUV 4:2:2 Packed (YCbCr 422), Bayer (8, 12), RGB 8	
Interface	USB 3.0	Basler BCON (LVDS)
Exposure Control	Via external trigger or programmable via the camera API	
Housing Size Camera (L×W×H)[mm]	20×29×29	17.5×29×29
Lens Mount	S-mount (M12)	
Digital I/O	2 Fast-GPIO	1 LVDS input, 2 outputs
Power Requirements	Via USB 3.0 interface	Via Basler BCON interface
Power Consumption (typical)	~1.3 W	~1.4
Conformity	CE, FCC, RoHS, USB3 Vision	CE, FCC, RoHS
Lens		
Lens Model	Evetar M12B0816W F1,6 f8 mm 1/2″	
Focal Length	8 mm	
Processing Board		
Board Model	–	AVNET 7010 MicroZed SOM
SoC	–	Zynq-7010 by Xilinx
Size (L×W×H)[mm]	–	101.6×57.2×25.5
Interfaces	–	10/100/1000 Ethernet,USB 2.0, USB-UART
Memory	–	1 GB DDR3 SDRAM, 128 MB QSPI Flash
Software / Driver		
Driver	Basler pylon Camera Software Suite	
Operating System	Windows, Linux, Mac OS X	Linux
Conformity	USB3 Vision, GenICam	GenICam

Specifications are subject to change without prior notice.
Latest specifications and availability can be found on our website *www.baslerweb.com/evkits*.
Please visit *www.baslerweb.com/manuals* for the detailed camera User's Manual and *www.baslerweb.com/thirdparty* for information on third party software.

BCON
for MIPI

Specifications

Embedded Vision Kits	dart BCON for MIPI Development Kit
Components	
Scope of Delivery	Camera module, lens, processing board, mezzanine board , power supply, cables (USB, HDMI, FFC, Ethernet) and accessories
Camera	
Camera Model	daA2500-60mc
Resolution (H×V pixels)	2592×1944
Sensor	ON Semiconductor AR0521, 1/2.5″, CMOS, rolling shutter
Pixel Size [µm^2]	2.2×2.2
Frame Rate [fps]	60
Mono / Color	Color
Video Output Format	YUV 4:2:2 Packed (YCbCr 422), RGB 8
Interface	BCON for MIPI
Exposure Control	Automatic, manual, programmable via the camera API
Housing Size Camera (L×W×H)[mm]	17.5×29×29
Lens Mount	S-mount (M12)
Digital I/O	2 inputs, 2 outputs
Power Requirements	Via BCON for MIPI interface
Power Consumption (typical)	~0,6 W
Conformity	CE, FCC, RoHS, MIPI CSI-2
Lens	
Lens Model	Evetar M12B0816W F1,6 f8 mm 1/2″
Focal Length	8 mm
Processing Board	
Board Model	DragonBoard 820c
SoC	Qualcomm Snapdragon 820
Size (L×W×H)[mm]	100 x 85 x 15 (96Boards CE – extended B)
Interfaces	10/100/1000 Ethernet, Wi-Fi, USB 2.0, USB 3.0, HDMI, Mini PCI Express
Memory	3GB LPDDR4 RAM, 32GB UFS Flash
Software / Driver	
Driver	Basler pylon Camera Software Suite
Operating System	Linux – 32 bit and 64 bit
Conformity	GenICam

Specifications are subject to change without prior notice.
Latest specifications and availability can be found on our website *www.baslerweb.com/evkits*.
Please visit *www.baslerweb.com/manuals* for the detailed camera User's Manual and *www.baslerweb.com/thirdparty* for information on third party software.

Step-by-Step Development for all Requirements

Basler cameras are highly flexible and versatile – so it's up to you to decide on your own specific system setup. If you use an off-the-shelf ARM-based or x86-based single-board computer, you will find an efficient solution with a Basler dart or ace camera and the Basler pylon SDK for both camera families. The SDK is easy to install and you can gain camera access (and thus images) within seconds. pylon has been successfully tested on DragonBoard, Raspberry Pi, NVIDIA Jetson TK1, Odroid-U3, and many other processing boards.

BCON for MIPI and Qualcomm Snapdragon Processors: The Ideal Combination

The dart camera module with BCON for MIPI interface pursues the path of efficiency in a notably consequent way: For the first time, a Basler camera is making use of the unmatched Image Signal Processors (ISP) of Qualcomm's Snapdragon SoCs. All other Basler cameras or camera modules come with their own ISP as part of their hardware and firmware. This gives them the flexibility to be operated on any target platform as image preprocessing is already performed on the camera side. This approach however is not the most efficient one: As most SoCs provide a dedicated hardware block for image preprocessing anyway - why not making use of it and getting rid of a costly hardware block on the camera side?

Qualcomm's SoCs are in particular famous for their highest quality ISPs, which is proven by the fact that it is able to get good image results even out of smart phone sensor modules. The challenge for any camera vendor however is to program and orchestrate the ISP in a way that in combination with a high quality image sensor it actually delivers the perfect image even for vision applications.

This requires not only excellence and years of experience in image pre-processing, it also demands a very narrow partnership to the SoC vendor Qualcomm. Basler has established such exclusive partnering and was able to implement its leading knowledge in image preprocessing into the Snapdragon Spectra™ ISP. This allowed on the other side to leave away the camera hardware block (FPGA) which realized the camera-side ISP. This economization is delivered to

our customers, offering a best in class and best in cost camera module.
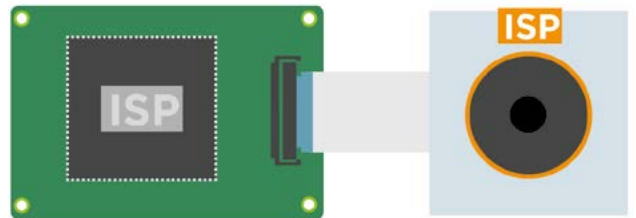
Standard Camera Module with own ISP (implemented in Camera FPGA)
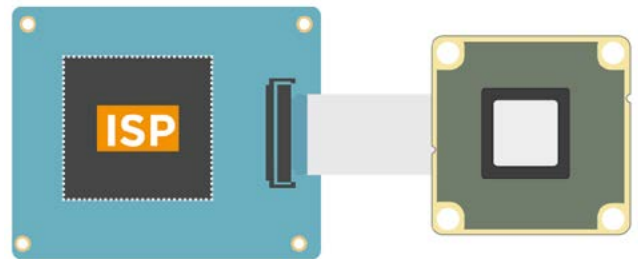
Basler Camera module using the ISP of the target system

Main benefits:

- Quasi plug and play operation on supported Snapdragon SoCs

- Different feature sets available for best matching the application's requirements

- Usage of the Snapdragon's internal Spectra™ ISP offering perfect image quality

- Development kit for easy start and prototyping

- pylon Camera Software Suite with unified camera API

Basler provides the needed Driver Package for the supported Snapdragon SoCs. This driver package includes the ISP logic, which realizes former camera firmware functionality now on the Snapdragons Spectra ™ ISP. The Driver Package also implements the interface to the pylon Camera Software Suite so that the dart MIPI module will offer the same convenient API as all other Basler Cameras and makes it a fully GenICam compliant device.

LVDS-Based Integration Made Easy

For a lean FPGA-based system setup using a SOM or a custom-designed processing unit along with the LVDS-based BCON interface, Basler provides support for all steps of integration.

The preceding camera evaluation is straightforward: all Basler cameras with BCON for LVDS interface are also available with a plug and play USB 3.0 interface, so that information on camera performance is available immediately, also on Linux, Windows, and Mac OS X.

After connecting a BCON camera to your system, you can benefit from the pylon SDK similarly. Using the standardized I²C data bus, pylon accesses the camera directly, without further actions required on most systems. Via the pylon API, you can simply configure the camera using your software application.

The grabbing of images via LVDS must be adapted to the specific hardware and system setup, e.g. by an individual FPGA implementation. To facilitate this process, Basler provides a development kit with a reference design. Combined with BCON's open documentation and a well-defined software protocol, creating the grabbing algorithms becomes straight forward at minimized risk.
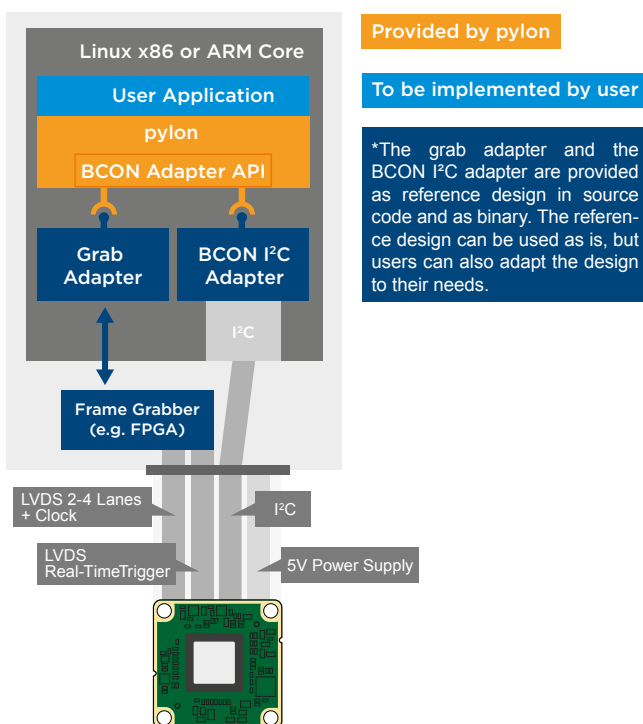
Main benefits:

- Access to camera from your software code via pylon API; same pylon APIs for all platforms and interfaces

- Development kit with example code for creation of LVDS-based image grab routine

- Clear, open interface documentation and SW protocol description

- Easy pre-evaluation with plug and play USB camera models and evaluation kit

Easy Code Transfer

The great advantage of pylon is its universality as it works equally on desktop and embedded platforms with different operating systems. This means that existing applications (and thus the code for camera operation via pylon) can be re-used. New applications can be developed conveniently on a desktop system and transferred to the embedded board at a later stage.

Changing the interface – e. g. from USB 3.0 to BCON – becomes simpler as well. This is not only because the cameras provide the same features, but because the software code can be reused (at least in parts), reducing integration and development efforts to a minimum.

Linux x86 or ARM Core
User Application
pylon
BCON Adapter API

| Grab Adapter | BCON I²C Adapter |

I²C

Frame Grabber (e.g. FPGA)

LVDS 2-4 Lanes + Clock

I²C

LVDS Real-TimeTrigger

5V Power Supply

Provided by pylon

To be implemented by user

*The grab adapter and the BCON I²C adapter are provided as reference design in source code and as binary. The reference design can be used as is, but users can also adapt the design to their needs.

INTEGRATION

IDEA AND SPECS FOR NEW EMBEDDED VISION APPLICATION

DECISION ON INTERFACE

USB3 VISION   BCON for LVDS   BCON for MIPI

dart USB Evaluation Kit

All-in-one kit incl. pylon SDK

Easy camera evaluation
(image quality, features, etc.) via plug and play USB camera

dart BCON for LVDS or BCON for MIPI Development Kit

Integration evaluation

Reference setup

pylon SDK with one API for all platforms

Application development
If applicable: start development on desktop PC, migrate to embedded system later. Existing code can be reused.

pylon SDK with one API for all platforms

Off-the shelf hardware integration

Custom board integration

Blueprints for board design

If an BCON-based solution is required at a later stage

BCON for LVDS: Implementation of image grabbing logic on FPGA

BCON for LVDS only: FPGA reference design

Final application
based on **USB** interface

Final application
based on **BCON** interface (MIPI or LVDS)
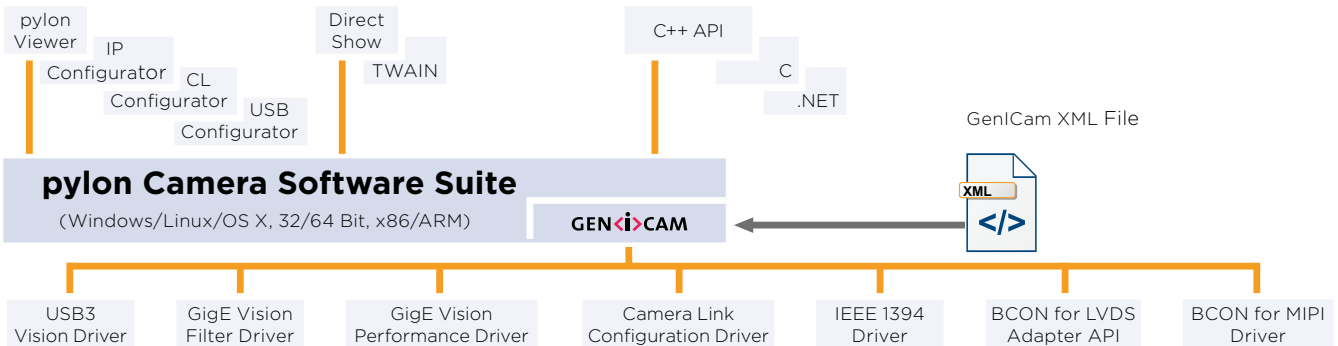
IDEA & CONCEPT

CAMERA EVALUATION

DEVELOPMENT & INTEGRATION

APPLICATION

17

Basler pylon Camera Software Suite

The pylon Camera Software Suite operates with all Basler cameras – no matter what interface they use. It offers stable, reliable, and flexible data exchange between Basler cameras and computer systems: for Linux on ARM-based systems, but also on Windows, Linux and OS X on x86 – at a very low processor load.

pylon Viewer

IP Configurator

CL Configurator

USB Configurator

Direct Show

TWAIN

C++ API

C

.NET

GenICam XML File

XML `</>`

pylon Camera Software Suite
(Windows/Linux/OS X, 32/64 Bit, x86/ARM)

GEN‹i›CAM

| USB3 Vision Driver | GigE Vision Filter Driver | GigE Vision Performance Driver | Camera Link Configuration Driver | IEEE 1394 Driver | BCON for LVDS Adapter API | BCON for MIPI Driver |

The architecture of the pylon Camera Software Suite is based on GenICam technology, which offers easy access to the newest camera models and the latest features. Changing an existing camera in any application essentially becomes a plug and play process.

An easy-to-use set of tools lets you configure the camera's interface. Use the pylon Viewer to set camera parameters, to capture and display images, and to evaluate the camera. pylon also contains a powerful SDK that supports any type of application development.

Besides other Basler camera interfaces like GigE Vision etc., pylon also supports USB 3.0, BCON for MIPI and BCON for LVDS for embedded vision application. pylon's programming interface (API) for creating user-specific applications is the same for all these interfaces. This fact makes migrations from one camera model or one camera interface technology to another very easy.

pylon for USB 3.0 interface

pylon contains a USB3 Vision Driver which fully supports the USB3 Vision standard. It allows the camera to use the full speed and bandwidth of USB 2.0 or USB 3.0 for image transmission, while reducing resource load and using off-the-shelf hardware components.

The pylon SDK is available for Windows, Mac OS X, and Linux (on x86/x64 and ARM-based systems) and allows the creation of applications in C, C++, and .NET languages (e.g. C#, VB.NET).

pylon for BCON for MIPI interface

pylon also supports the BCON for MIPI interface on Linux/ARM based platforms with Qualcomm Snapdragon SoCs. Along with Basler's Driver Package all image preprocessing is offloaded to the SoC's internal Image Signal Processor (ISP), the CPU itself is not affected. This allows ultra-lean and cost-efficient designs with no additional hardware required, the full CPU and GPU power of the Snapdragon SoC is still available for the actual image-processing task. With this setup the integration of the camera module becomes actually a plug and play procedure. Due to the GenICam compliance pylon offers full access to all camera parameters and eases the image acquisition as for any other Basler camera interface.

pylon for BCON for LVDS interface

The proven and user-friendly pylon Camera Software Suite also supports Basler's BCON for LVDS interface and is available for Linux on x86 or ARM-based systems.

Based on GenICam technology, the camera configuration is performed via the I^2C bus of the Linux system. For this purpose, pylon introduces the BCON Adapter API which needs to be implemented in order to let pylon communicate with the system's I^2C bus. A ready-to-use sample implementation is provided as binary as well as in source code – it can be used as-is without any modification or as a blueprint for a custom adapter implementation.

About Basler

Basler is a leading manufacturer of high-quality digital cameras and accessories for industry, medicine, traffic and a variety of other markets. The company's product portfolio encompasses area scan and line scan cameras in compact housing dimensions, camera modules in board level variants for embedded solutions, and 3D cameras. The catalog is rounded off by our user-friendly pylon SDK and a broad spectrum of accessories, including a number developed specially for Basler and optimally harmonized for our cameras .

Basler has 30 years of experience in computer vision. The company is home to approximately 500 employees at its headquarters in Ahrensburg, Germany, and its subsidiaries and sales offices in Europe, Asia, and North America.

3-Year Warranty

Basler offers a 3-year warranty for their cameras and Basler Lenses 1/2.5". We make this unprecedented promise because we have unparalleled confidence in our products. We continually reinvest in research, development and superior manufacturing capabilities so that our customers can fully rely on the products we manufacture.

Discover Basler

For more information about Basler's offering for your individual embedded vision application please visit:

www.baslerweb.com/embedded

Or stay in touch through our social media channels:

How Does Basler Ensure Superior Quality and Reliable High Performance?

Our approach to quality assurance is rigorous: we continually audit all facets of our business to ensure powerful performance, increase efficiency and reduce costs for our customers. We are compliant with all major quality standards including ISO 9001, CE, RoHS, and more.

To ensure consistently high product quality, we employ several quality inspection procedures during manufacturing. Every Basler camera is subjected to exhaustive optical and mechanical tests before leaving the factory. Regardless of what technology or camera model you choose you can be assured of consistent performance.

"Basler has always been in on the ground floor of game-changing camera technology and it's in our DNA to move forward. By embracing and shaping embedded vision technology, we bring new value to applications that touch our lives every day.

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