BASLER CAMERAS FOR

MEDICAL & LIFE SCIENCES

- Outstanding performance to price ratio –
  with CMOS sensors better than ever

- Reliable long-term availability –
  through best-in-class quality

- Reduced certification efforts for medical devices –
  in compliance with ISO 13485:2016

BASLER
the power of sight

MOST PRISTINE & COLORFUL PICTURES
Outstanding image quality

- Powerful MED Feature Sets integrated in Basler's MED ace
- True colors, clear contrasts, high resolution, fast live images
- Outstanding performance stability due to high quality standards

CARE-FREE CAMERA LIFE CYCLE
### Comprehensive support and services

- 3-year warranty on entire camera portfolio
- Ad-hoc service by Basler's technical support
- Point of contact at your site via Basler worldwide network of offices

PURCHASE DECISION WITH MINIMUM RISK
### Secure future investment

- Long-lasting camera life and reliability through numerous quality assurance measures
- Long-term availability of cameras
- Outstanding ratio of performance to price
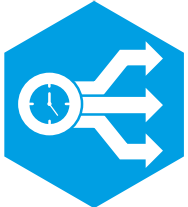
YOUR PARTNER FOR OPTIMUM DESIGN-IN PHASE
Easy system integration

- Compliant to ISO 13485:2016 with Basler's MED ace
- Individual consulting and customized products
- Basler support teams located worldwide
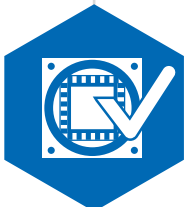
SELECTING YOUR PERFECT CAMERA
Broad portfolio range

- Over 300 camera models provide cost-efficient and high-end performance also for industrial applications
- Resolutions up to 20 MP, high speed with up to 751 fps
- Monochrome or color variants and near-infrared (NIR) enhanced versions

DEFINING YOUR SYSTEM REQUIREMENTS
Supported by experts

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

Camera Offering for Medical & Life Sciences

MED ace

PowerPack for Microscopy

Cameras for Embedded Vision

boost Bundle

blaze

Components

Deep Learning

Sensor Technology Shift: CMOS Now Better Than CCD

The world-leading manufacturer of CCD sensors Sony decided in 2015 to stop producing and investing in this technology, no major new inventions or developments have been made to expand CCD technology. CMOS technology, on the other hand, has experienced heavy investments. It can now match the high quality of CCD sensors and deliver even better image quality.

The following table contains typical CCD sensors which have been integrated into many cameras in the Medical & Life Sciences domain. The specifications show the advantages of the next-generation CMOS sensors offered when choosing one of Basler's MED ace cameras:

Comparison	CCD	CMOS	CCD	CMOS
Camera Model	scout	MED ace 2.3 MP 164 mono	pilot	MED ace 5.1 MP 75 mono
Sensor	Sony ICX285	Sony Pregius	Sony ICX625	Sony Pregius
Resolution	1.4 MP	2.3 MP	5.0 MP	5.0 MP
Pixel Size	6.45 µm	5.86 µm	3.45 µm	3.45 µm
Frame Rate	17 fps	164 fps	17 fps	75 fps
Quantum Efficiency	58 %	70 %	47 %	67 %
Temporal Dark Noise	8 e⁻	7 e⁻	13 e⁻	2 e⁻
Dynamic Range	68 dB	74 dB	55 dB	73 dB

Specifications are subject to change without prior notice. Latest specifications can be found on our website *baslerweb.com/MEDace*

Read more at *baslerweb.com/CMOS-in-Medicine*

BASLER MED ACE

Basler MED ace cameras are our first camera series specifically designed for Medical & Life Sciences and are the perfect answer to the discontinuation of CCD sensors. Equipped with CMOS sensor technology at its best, the MED ace delivers even better image quality at much lower costs than CCD cameras.

With Sony's powerful Pregius sensors and exceptional PYTHON sensors by ON Semiconductor, the MED ace stands out with up to 164 fps and 20 MP, pixel sizes up to 5.86 μm, low temporal dark noise down to 2e- and sensor sizes up to 1.1 inch.

Compliant with ISO 13485:2016

With the certification according to ISO 13485:2016, we have proven our quality standards for production, distribution and service of digital cameras, as well as for placing them on the market.

For you, this means consistency, reliability and quality. Whether you want to operate internationally or expand locally, the ISO 13485 certification helps you to achieve quick time to market. Let us assist you with documentation and preparation for the certification of your medical device.

Basler pylon Camera Software Suite

The pylon Camera Software Suite is a software packet from and for Basler cameras. This lets you activate your MED ace camera via a Mac, Windows or Linux PC – quickly and easily.

Basler's Powerful MED Feature Sets

Our unique and industry-leading MED Feature Sets for Medical & Life Sciences deliver everything that our customers are looking for. They combine market-leading hardware, firmware and pylon software features:

Easy Compliance		Brilliant Image
Low Light Imaging		High Speed
Perfect Color		Industrial Excellence
Dust Protection		

We developed these unique features specifically to address the high imaging demands in Medical & Life Sciences and to reduce our customers' development efforts.

Overview of MED ace	
Sensor Technology	State-of-the-art CMOS sensors
Sensors	Sony Pregius: IMX174, IMX249, IMX250, IMX264, IMX255, IMX267, IMX253, IMX304, IMX183; ON Semiconductor: PYTHON 5000
Frame Rate	Up to 164 fps
Resolution	Up to 20 MP
Pixel Size	Up to 5.86 μm
Temporal Dark Noise	Down to 2 e-
Sensor Sizes	Up to 1.1 inch
Interface	USB 3.0 Vision, GigE Vision
Benefits	Including high-performance MED Feature Sets designed for Medical & Life Sciences

Specifications are subject to change without prior notice. Latest specifications can be found on our website.

Read more at *baslerweb.com/MEDace*

BASLER POWERPACK FOR MICROSCOPY

The Basler PowerPack for Microscopy is a fully equipped package for image acquisition in microscopy. It consists of a microscopy camera, as well as professional microscopy software, USB 3.0 cable and quick installation guide. The additional video recording software allows capturing of single images, recording of videos or image sequences for time-lapse microscopy.

Thanks to its plug-and-play setup, the PowerPack for Microscopy allows end users a simple system setup and easy installation.

Basler Microscopy pulse

The Microscopy pulse camera with resolutions between 1.2 MP and 5 MP comes with USB 3.0 as standard interface and USB 2.0 backward compatibility. The camera was specifically designed to be cost-effective and easy to use. High frame rates allow for smooth live viewing, fast focusing and sample screening. The well-established ON Semiconductor CMOS sensors offer accurate and reproducible results for a broad range of standard microscopy applications.

Basler Microscopy ace

The Microscopy ace cameras feature Sony's state-of-the-art IMX CMOS sensors. Thanks to these global shutter sensors, the cameras offer low noise levels down to 2.2 e$^-$, a large dynamic range of roughly 73 dB, and quantum efficiencies over 70 %. Similarly, Microscopy ace models with resolutions up to 12.2 MP achieve a new level of image quality. They are the ideal choice for moderate-to-challenging microscopy applications. High frame rates of up to 200 fps allow tracking of fast objects, fast focusing and sample screening even at full resolution.

Overview of PowerPack for Microscopy	
Sensor Technology	Latest CMOS sensors
Frame Rate	Up to 200 fps
Resolution	Up to 12 MP
Pixel Size	Up to 5.86 µm
Temporal Dark Noise	Down to 2 e$^-$
Sensor Sizes	Up to 1 / 1.2 inch
Interface	USB 3.0
Benefits	Plug-and-play package for microscopy applications

Specifications are subject to change without prior notice. Latest specifications can be found on our website.

Read more at *baslerweb.com/MicroscopyPowerPack*

BASLER EMBEDDED VISION

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 to achieve the right combination of high performance, low cost, low power and programmability.

Current Trends for Medical Device Manufacturers

- 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.

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

These trends 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, we are helping make innovative medical devices more robust, reliable, flexible and cost effective.

Basler dart

Versatile camera modules for embedded applications

Embedded Vision Kits

User-friendly evaluation and development kits

Overview of dart	
Sensor Technology	Latest CMOS sensors
Sensors	ON Semiconductor: AR0134, AR0521, MT9P031; Sony Pregius: IMX392; Sony Starvis: IMX334; e2v: EV76C570
Frame Rate	Up to 160 fps
Resolution	Up to 13 MP
Pixel Size	Up to 4.5 µm
Temporal Dark Noise	Down to 6 e$^-$
Sensor Sizes	Up to 1 / 1.8 inch
Interface	USB 3.0 Vision, BCON for LVDS, BCON for MIPI
Benefits	BCON for MIPI for best price/performance ratio BCON for LVDS for direct FPGA connection USB 3.0 Vision for easy integration

Specifications are subject to change without prior notice. Latest specifications can be found on our website.

Read more at *baslerweb.com/embedded*

BASLER BOOST BUNDLE

The Basler boost camera series combines latest CMOS sensor technology with high bandwidths. Together with the well-tailored CXP-12 interface card 1C, we also offer the boost in a bundle and thus as two perfectly harmonized components.

The boost Bundle for Medical & Life Sciences at a Glance

- CXP-12 camera and CXP-12 interface card from one source

- Reduction of system complexity and costs

- Simple installation of camera and interface card through GenTL and the pylon Camera Software Suite (SDK)

- Outstanding image quality thanks to Sony Pregius sensors

- CoaXPress 2.0 interface and standardized Micro-BNC (HD-BNC) cable connection

- High transfer speed up to 12.5 Gbps and high resolution up to 12 MP

Application Example: Surgical Microscopy

The bundle is suitable for applications in Medical & Life Sciences where the priorities are high resolutions, fast data rates and low latency periods, with low integration costs at the same time. Surgical microscopes with an integrated camera are one example. Equipped with the latest Sony Pregius sensors our boost cameras offer excellent image quality and high color fidelity. With a resolution of 4K, the cameras provide images with 60 fps and enable views of the surgical process or the marking of tumors in fluorescence-assisted operations.

Overview of boost	
Sensor Technology	Latest CMOS sensors, global shutter
Sensors	Sony Pregius: IMX253, IMX255
Frame Rate	Up to 93 fps
Resolution	Up to 12 MP
Pixel Size	3.45 µm
Temporal Dark Noise	Down to 2 e⁻
Sensor Sizes	Up to 1.1 inch
Interface	CoaXPress 2.0 (CXP-12)
Benefits	Standardized cable connection: Micro-BNC (HD-BNC) Cable lengths of up to 40 m with max. bandwidth Available for C-mount, F-mount and M42-mount lenses

Specifications are subject to change without prior notice. Latest specifications can be found on our website.

Read more at *baslerweb.com/boost*

BASLER BLAZE

The Basler blaze industrial 3D camera operates on the Time-of-Flight (ToF) principle and stands out with high precision for 3D imaging in real time. Its laser diodes (VCSEL) work in the NIR range (940 nm), generating 2D and 3D data in one shot with a multipart image, incorporating range, intensity and confidence maps. Typical applications in Medical & Life Sciences include patient positioning, patient monitoring, biometrics or surgical robots.

The blaze for Medical & Life Sciences at a Glance

■ Outstanding 3D imaging with the latest Sony DepthSense™ IMX556PLR sensor technology

■ Precise, millimeter-accurate optical measurement with the time-of-flight method

■ Real-time streaming of 3D point clouds and 2D intensity images

■ Large measuring range

■ IP67 protection

■ Light and contrast independent

■ Easy system integration thanks to compact design and GigE Vision

■ Invisible and eye-safe NIR illumination

Application Example: Patient Positioning in Radiology

The exact position of the patient has a decisive influence on the quality of an X-ray image. An automatic, almost millimeter-precise positioning enables sharp, exact images, reduces the effort for the medical personnel and minimizes the necessary radiation dose.

Overview of blaze	
Sensor	Sony DepthSense™ IMX556
Frame Rate	30 fps
Resolution	VGA
Interface	GigE
Field of View	60° × 45°
Working Range	0-10 m
Accuracy	<5 mm @ 0.3-6 m; typical
Protection Class	IP67
Illumination Type	940 nm VCSEL

Specifications are subject to change without prior notice. Latest specifications can be found on our website.

Read more at *baslerweb.com/blaze*

BASLER'S VISION COMPONENTS

An image processing system needs more than just a camera. Only a lens, light source, reliable data transfer and additional components such as frame grabbers, trigger cables, PC cards and power supplies turn a vision system into a functioning unit. We offer a large selection of vision components that match each other perfectly.

Vision Components at a Glance

■ Compatible with our MED ace cameras

■ Broad and harmonized product portfolio

■ Matching, certified and tested vision components

■ Long-term availability

■ In-house developments or developments in cooperation with other companies

■ One-stop shopping

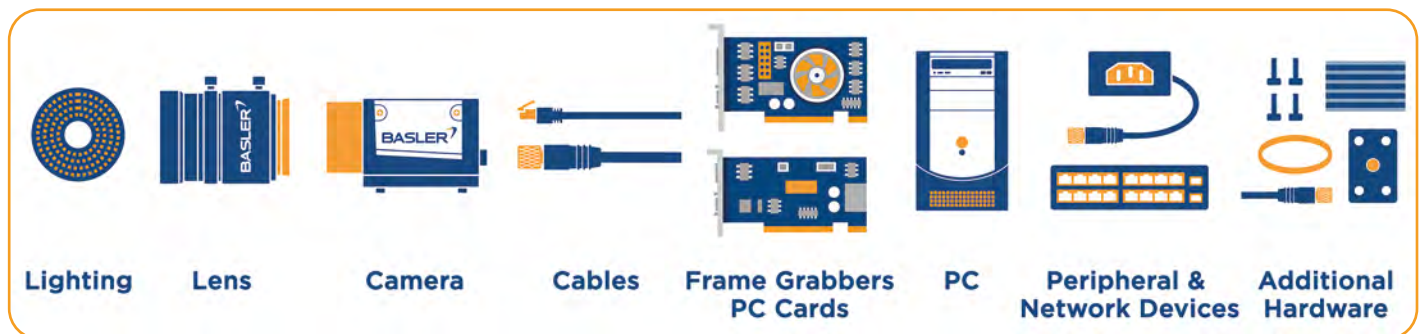■ Professional consulting before and after the buying decision

Need Help Selecting the Right Vision Components for Your Application?

Select compatible components for your vision system with the help of our Vision System Configurator: *baslerweb.com/vision-system-configurator*

Step by step you can pick cameras, lenses, power and data cables as well as other accessories. We ensure that the selected components fit together.

Typical set-up of a camera system

| Lighting | Lens | Camera | Cables | Frame Grabbers PC Cards | PC | Peripheral & Network Devices | Additional Hardware |

Read more at *baslerweb.com/vision-components*

VISION SYSTEMS FOR DEEP LEARNING

Deep learning is rapidly spreading across Medical & Life Sciences applications and helps for example in pathology detection in microscopy. The benefits of artificial neural networks (ANNs) are twofold. ANNs have the potential to improve the accuracy and robustness for applications. At the same time, ANNs have the capability to solve image-based application problems that could not be solved in the past.

The Advantages of Deep Learning Compared to Classical Rule-based Algorithms

- Classification of complex images

- Improved accuracy and robustness

- Automatic feature extraction

Our products are well suited for inference of ANNs. We are offering a variety of products to choose from when designing a deep learning vision system.

Best performance, fastest inference per second, highest reliability – if your application demands high throughput, the **FPGA frame grabber-based system** is the right fit for you.

Thanks to our plug-and-play hardware and software components **PC-based systems** score with an easy design-in. Our broad camera portfolio and the pylon Camera Software Suite make it easy to deploy your ANN without spending too much integration effort.

The most compact and cost-effective vision systems can be designed using **embedded vision technology**. The combination of board level cameras and embedded processing units ensures the lowest cost per unit.

FPGA Frame Grabber-Based Systems

Fastest inference and highest reliability.

PC-Based Systems
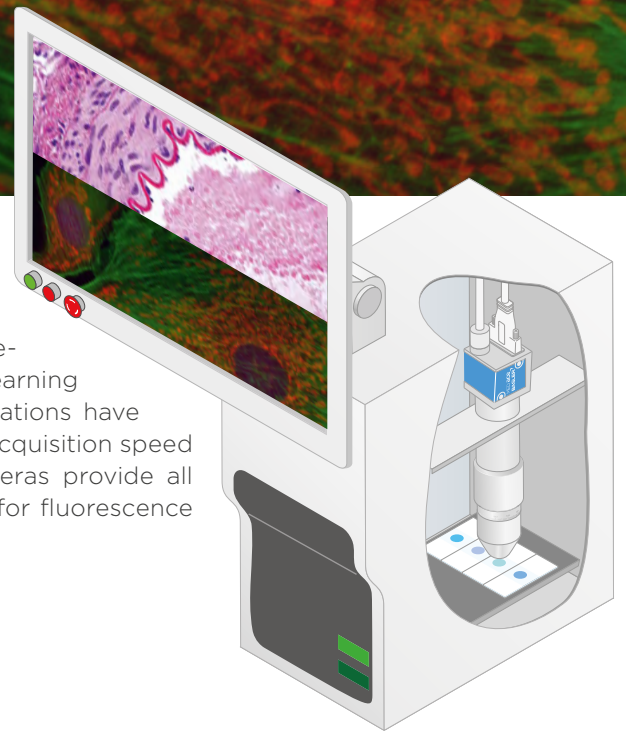
Fast time-to-market with lowest integration costs.

Embedded Vision Technology

Most compact and cost-effective solutions.

Read more at *baslerweb.com/deep-learning*

AUTOMATED MICROSCOPY

Best Fit for Automated Microscopy

The role of automation in microscopy is increasing rapidly. Involvement of artificial intelligence includes algorithms such as deep learning for automated analysis e.g. in medical diagnostics. These applications have tough demands for digital cameras: excellent image quality, high acquisition speed and a rich set of camera control functions. Our MED ace cameras provide all these requirements under conventional light conditions but also for fluorescence applications.

RECOMMENDED CAMERAS

Basler MED ace
MED ace 2.3 MP 164 mono / color
MED ace 5.1 MP 75 mono / color
MED ace 6.4 MP 59 mono / color
MED ace 12.3 MP 30 mono / color
MED ace 20 MP 17 mono / color

Basler PowerPack for Microscopy
Microscopy pulse 5.0 MP color
Microscopy ace 2.3 MP mono / color

BENEFITS

Unique and powerful MED Feature Sets included in Basler's MED ace:

Brilliant Image
In-camera image optimization such as 5x5 debayering and sharpness enhancement for capturing the most delicate structures; smart auto contrast and quick auto brightness for changing light conditions

Perfect Color
Fully-controllable true 12-bit color pipeline for true color reproduction in slide scanning applications

Low Light Imaging
Our innovative long exposure mode for lowest noise, and excellent SNR for low light applications such as in fluorescence

Dust Protection
Meets special cleanliness requirements through the sealing of the sensor room and the separate production of our MED ace in a cleanroom with strict tests for dust and other particles

Plug-and-play bundle for a variety of microscopy tasks, which includes:

- Microscopy camera
- Professional microscopy software
- Video recording software
- USB 3.0 cable
- Quick install guide

Best Fit For Your Molecular Diagnostic Instrumentation

CMOS cameras are integrated into high-sensitivity detection modules used for analysis of proteins and nucleic acids in a variety of biological samples. Modern analyzers for in-vitro diagnostics (IVD) use highly-sensitive and fluorescence-based detection methods e.g. in microarrays or microfluidic systems.

We provide long-lasting products of the highest reliability and proven industrial-grade quality. Additionally, we offer short integration times by providing a user-friendly software development kit (SDK). Our experienced global support ensures fastest time-to-market for your upcoming products.
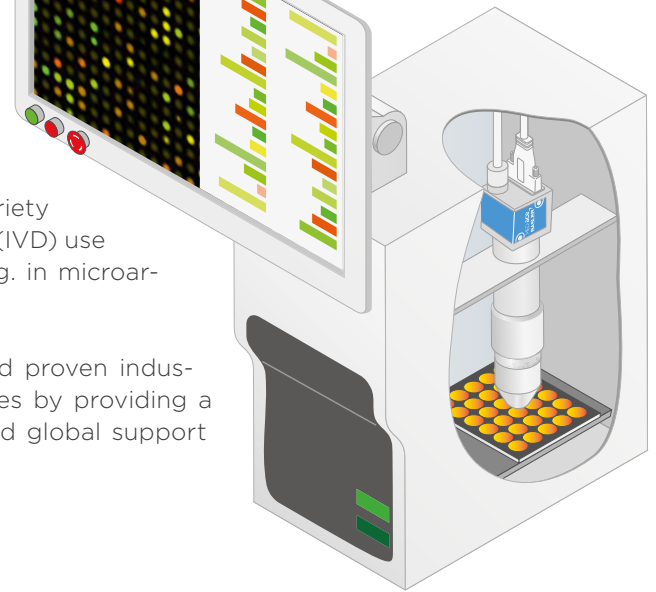
RECOMMENDED CAMERAS

Basler MED ace
MED ace 2.3 MP 164 mono / color
MED ace 5.1 MP 75 mono / color
MED ace 6.4 MP 59 mono / color
MED ace 12.3 MP 30 mono / color
MED ace 20.0 MP 17 mono / color

BENEFITS

Unique and powerful MED Feature Sets included in Basler's MED ace:

Low Light Imaging
High sensitivity, low dark noise, as well as our unique long exposure mode for applications with difficult light conditions and weak signals

Easy Compliance
Compliant with ISO 13485:2016 for minimized certification efforts and proven reliability in in-vitro diagnostic instruments

Industrial Excellence
Optimized design together with exceptional price/performance ratio for highest flexibility in use; state-of-the-art USB3 Vision interface for standardized, easy, robust integration

PROCESS AUTOMATION

## Best Fit for Process Automation

Trust in your results – our cameras identify samples and labware by reading matrix codes and are used for internal quality control. They provide flexibility in use and easy integration in countless lab instrumentation products. In combination with an optimized design and small form factor, our cameras grant high speed and resolution, reliability, accuracy and image quality with an exceptional price/performance ratio.
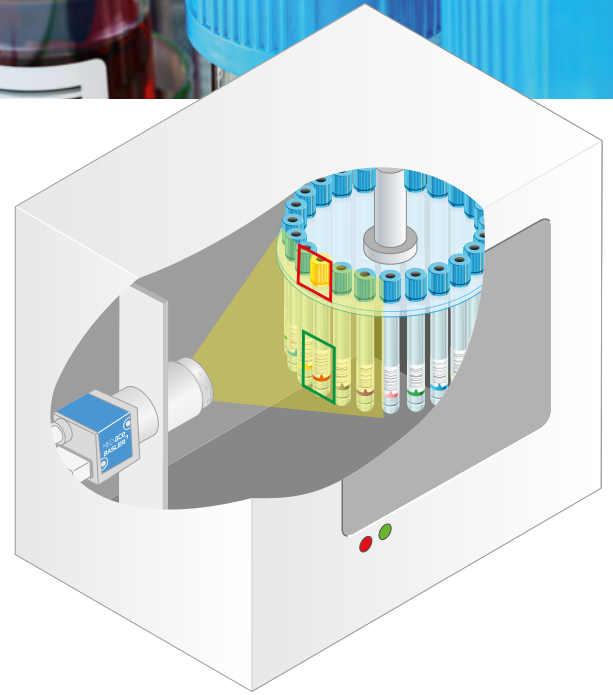
RECOMMENDED CAMERAS

Basler MED ace
MED ace 2.3 MP 164 mono / color
MED ace 5.3 MP 20 mono / color
MED ace 6.4 MP 59 mono / color
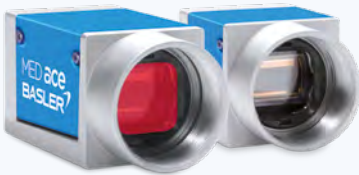
BENEFITS

Unique and powerful MED Feature Sets included in Basler's MED ace:

Brilliant Image
Outstanding image out-of-the-box; sharp contrasts for reliable and quick barcode reading

High Speed
Fast and yet highly reliable cameras; high frame rates and global shutter sensors for fast image acquisition and maximum throughput

Industrial Excellence
User-optimized, one-for-all SDK ensures fast integration of new camera models and gives access to all camera features thanks to GenICam technology
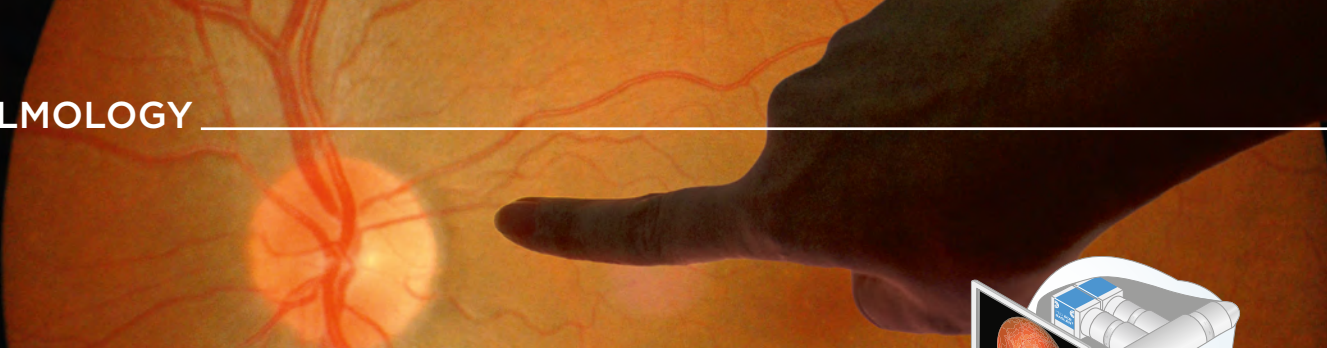
Basler dart
daA1920-160uc with USB3 Vision Interface
daA2500-60mc with BCON for MIPI

Perfectly meets the requirements in process automation:

- Small form factor of 27 mm × 27 mm

- weight of only 5 g

- variety of mount options

- different interfaces such as USB 3.0 for ease of integration and BCON for MIPI for best price/performance ratio

Best Fit for Your Ophthalmology Instrumentation

Many diagnostic devices in modern ophthalmology already benefit from vision technology. Applications require superior image quality for visualization of the smallest vessel structures, as well as configurable color pipelines for the camera. We offer a wide range of MED ace cameras that are suitable for various applications such as fundus imaging using a fundus or OCT (optical coherence tomography) camera.

For cameras in ophthalmology, highly reliable color rendering as well as the reproducibility of the images is particularly important. Our patented 6 Axis Operator and Color Calibrator Tool adjust settings for hue, saturation, brightness and contrast for full control of color space.

RECOMMENDED CAMERAS

Basler MED ace
MED ace 5.1 MP 35 color
MED ace 5.1 MP 75 color
MED ace 6.4 MP 59 color
MED ace 12.3 MP 23 color
MED ace 12.3 MP 30 color
MED ace 20.0 MP 17 color

BENEFITS

Unique and powerful MED Feature Sets included in Basler's MED ace:

Brilliant Image
Sharp contrasts for visualization of the smallest vessel structures; easy-to-use auto functions for an outstanding image right out-of-the-box

Perfect Color
Our patented 6 Axis Operator for high color fidelity and excellent color reproduction supports the precise examination of eye compartments like the fundus; easy color calibration minimizes color errors

Easy Compliance
Compliant with ISO 13485:2016 for minimized certification efforts and proven reliability for ophthalmology applications

Basler dart
daA1280-54uc with USB3 Vision Interface
daA1280-54um with USB3 Vision Interface

Perfectly meets the requirements in ophthalmology:
- Small form factor of 27 mm × 27 mm
- weight of only 5 g
- variety of mount options
- USB 3.0 for ease of integration

SURGICAL IMAGING

Best Fit for Your Surgical Imaging Needs

Do not compromise in surgical environments – rely on MED ace cameras for light microscopic/stereoscopic visualization, fluorescence-based intraoperative visualization, minimally invasive, computer- and robot-assisted surgery, or intraoperative navigation.

Dependably high resolution up to 4K, plus pin-sharp images with high contrast and exact color fidelity guarantee the precise representation of the most complex and finest anatomical structures in realtime. The increasing trend of digitization makes critical components like cameras a must to achieve the required performance for intraoperative observation, image analysis or simulation.

RECOMMENDED CAMERAS

Basler MED ace
MED ace 5.1 MP 75 mono / color
MED ace 8.9 MP 42 color
MED ace 12.3 MP 30 color

BENEFITS

Unique and powerful MED Feature Sets included in
Basler's MED ace:

Easy Compliance
We produce and distribute the MED ace cameras under ISO 13485:2016 for minimized certification efforts and proven reliability in the surgical environment

Brilliant Image
Supreme image out-of-the-box for precise representation of the most complex and the finest anatomical structures; fast auto functions for quickly changing light conditions

Perfect Color
Precise color fidelity during surgical interventions due to our configurable color pipeline; easy color calibration in less than one minute based on commonly used reference chart minimizes color errors

BASLER
the power of sight

About Basler

Basler is a leading international manufacturer of imaging components for computer vision applications such as cameras, lenses, frame grabbers, software, as well as embedded vision solutions, customized products and consulting services. Basler's products are used in a variety of markets and applications, including factory automation, medical, logistics, retail, and robotics.

In the Medical & Life Sciences sector, Basler cameras are used in applications such as microscopy, ophthalmology, and laboratory equipment & automation. The MED ace is Basler's camera series specifically designed to meet the high image processing requirements in Medical & Life Sciences applications. All models are produced, distributed, and serviced according to the ISO 13485:2016 quality management standard. They also include the MED Feature Sets that combine powerful hardware, firmware, and software functions.

The Basler Group employs approximately 800 people at its headquarters in Ahrensburg, Germany, and other locations in Europe, Asia, and North America. Thanks to the worldwide sales and service organization and cooperation with renowned partners, it offers solutions that fit for customers from a wide range of sectors.

Trust in State-of-the-Art Vision Technology Made in Germany

Our experience makes Basler's equipment the most reliable and trusted industrial vision technology in the market. As a key driver of technology trends and vision standards, we measure our cameras and their components against the highest standards and offer outstanding quality for reproducible pictures and reliable analysis.

We are constantly developing and improving our products. Already today, we install many cameras into Medical & Life Sciences applications. These digital cameras must provide highest image quality and exceptional color reproduction. New advanced image enhancement and color adjustment algorithms enable consistent and repeatable color fidelity, and perfectly reproduce pictures of challenging samples. Thanks to exhaustive quality assurance measures, long-lasting camera life is a given. We also stand for long-term market availability of our cameras, to make your decision worthwhile and satisfying.

Find our White Papers, Customer Stories and more valuable information on:
baslerweb.com/medical

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