# SEE FAST TECHNOLOGIES

ProcImage500-Eagle – MONOCHROME VERSION

## SMART HIGH SPEED CAMERA
# ProcImage500-Eagle
## MONOCHROME VERSION

## High speed video – Smart triggers
## Embedded image processing

Based on a motherboard with a FPGA Zynq$^{TM}$, a 512 MB DDR3 and a USB 3.0 interface, the ProcImage500-Eagle offers all the features to perform high speed video.

It also implements smart triggers to optimize movie capture, and embedded image processing in real time to transfer only useful data.
Just use a standard PC with USB 3.0. No need for a specific acquisition card.

### Main specifications

- Sensor resolution : 1280 x 1024 pixels
- 505 fps at full resolution and more with ROI*
- Configurable ROI in size and position
- High Dynamic Range mode (HDR)
- Monochrome
- Real time recording on disk
- Ability to process images in real time into the camera and/or the PC
- Embedded programmable component Zynq$^{TM}$ from Xilinx
- Internal memory, DDR3 of 512 MB
- Microprocessor ARM$^{®}$ dual-core Cortex$^{TM}$-A9
- Ability to implement custom IP** inside the FPGA
- I/O : Trigger In/Out, Synchro In/Out, Strobe Out
- Smart Triggers (option)
- Embedded image processing (option)
- Standard USB 3.0 interface
- Simultaneous operation of several ProcImage500-Eagle on the same PC
- Long duration recording (several hours)
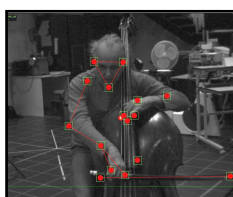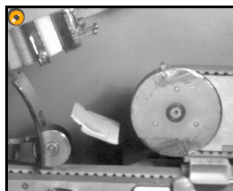- Camera control by EyeMotion Software

*Region Of Interest       **Intellectual Property

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## Application area

- Production line monitoring
- Bio-imaging
- Robotics
- Research
- Biomechanics
- Medical
- Sports
- Defense
- Security
- Education
- ...



## Applications

- Troubleshooting
- Process and quality control
- Dynamic feedback loop for fast events
- Augmented imaging
- Tracking Points of interest
- Image recognition with classifier
- Image stabilization
- 2D-FFT
- Development of new imaging methods
- Sports coaching
- Rehabilitation

## Operation modes

- **Standard high speed camera mode :**

    - Configuration of ROI, exposure time and frame rate
    - Direct recording to drive or to internal PC memory
    - Recording duration up to several hours according to the available disk space
    - Recording either in continuous or buffer mode
    - Trigger, event markers, manual / automatic start and stop by TTL signal or images analysis
    - Saving in proprietary format, .mov, .avi, images sequences
    - Slow motion playback

- **Smart high speed camera mode :**

    The ProcImage500-Eagle integrates a FPGA with enough memory and processing features to realize in real time embedded image processing on a data stream up to 625 MB/s (maximum speed of the sensor).

    The Xilinx® FPGA Zynq™-7020 combines both the raw real time parallel processing power of an Artix™-7 and the flexibility of an ARM dual-core cortex™-A9 microprocessor.
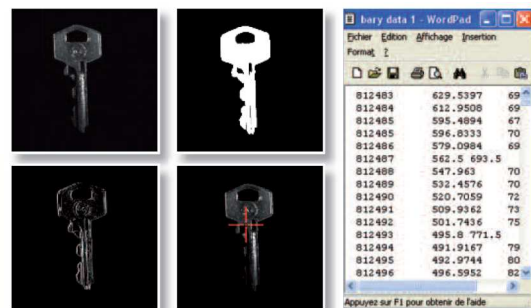


    The internal configuration of this FPGA is not definitively set. It is possible to reprogram it to perform real time custom image processing either by our engineers or by users with VHDL skills.

    In this case, we can supply to users a HDK (Hardware Development Kit) to give access to the FPGA and implement their own custom IP.
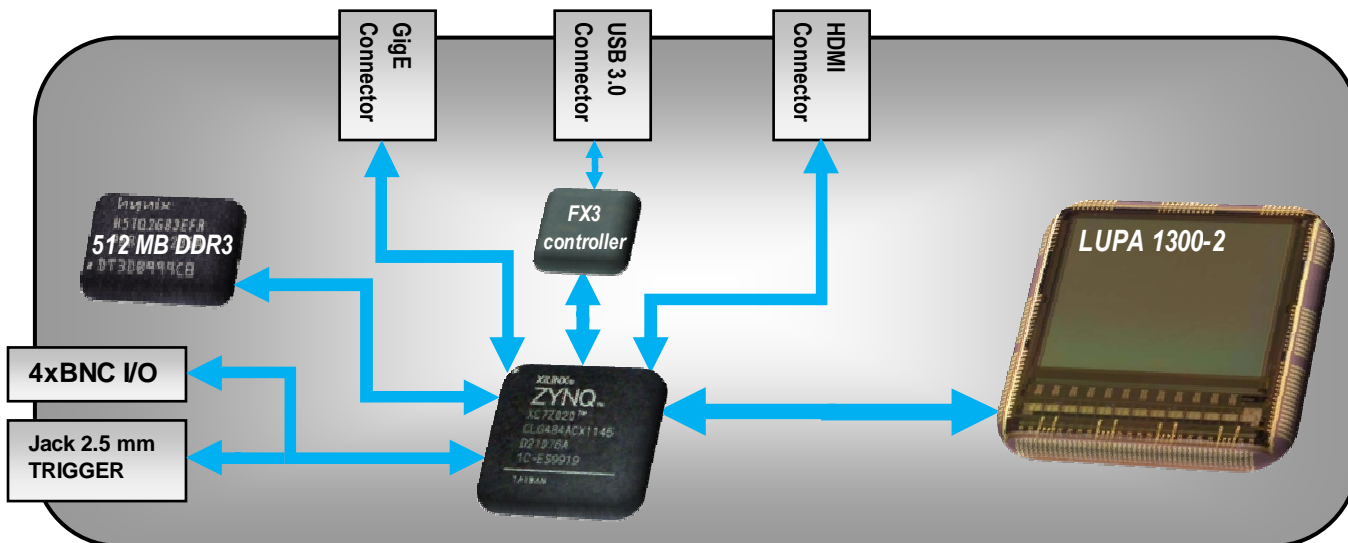
- **Stand alone camera mode :**

    In this mode the ProcImage500-Eagle can perform in real time an embedded image processing previously implemented in the FPGA and does not need any connection to a computer.

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## ProcImage500-Eagle architecture



These abilities are used to perform automatic image triggering, lossless compression or sub-sampled images and for instance images binarization, on the fly data generation like blobs edge or barycenter coordinates.

## Frame rate vs resolution (pixels) :

| Typical resolutions | $A^1$ – fps | $B / C^2$ – fps |
|---|---|---|
| 1280 x 1024 | 260 | 505 |
| 1280 x 512 | 521 | 1003 |
| 1280 x 256 | 1042 | 1982 |
| 1280 x 128 | 2084 | 3870 |
| 648 x 480 | 1060 | 1767 |
| 312 x 240 | 3750 | 5509 |
| 1008 x 1008 | 332 | 602 |
| 768 x 768 | 568 | 979 |
| 504 x 504 | 1250 | 2013 |
| 240 x 240 | 4500 | 6311 |

**A :** Direct recording to disk of 8 bits-images.
**B :** Direct recording to disk of lossless compressed or sub-sampled 8 bits-images.
**C :** Direct recording to disk or transfer the image processing outgoing data to a program with a data rate < 330 MB/s.

[1] Because of the USB 3.0 bandwidth and the drive write speed, the maximum frame rate is limited.

[2] In lossless compression mode, images presenting high noise areas can lead to trouble and limit this mode use.

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## Sensor specifications :

- Sensor : CMOS LUPA1300-2
- Resolution H x V : 1280 x 1024 pixels
- Pixel size : 14 x 14 µm
- Sensor size / diagonal : 17.92 mm x 14.34 mm / 22.95mm
- Frame rate : 505 fps at full resolution, faster frame rates with ROI*.
- Shutter : global
- Minimum shutter time : 2 µs
- Wavelength range : 400 – 1000 nm
- Pixel depth : 8 bits monochrome, 10 bits with HDK

  \* Region Of Interest

## Mechanical specifications :

- Camera size : 12.5 x 10.1 x 10.2 cm (without connectors and lens)
- Camera weight : 1.4 kg
- Lens mount : F or C-mount
- Threaded holes for camera tripod or M4, bottom and top side
- Working temperature : +5°C…+40°C
- 4 BNC connectors for I/O
- 1 mini-jack 2.5 mm connector for remote switch trigger
- 1 USB 3.0 type B connector
- 1 HDMI connector
- 1 Ethernet connector
- 1 power supply connector
- Power consumption < 10 W

## Hardware specifications :

- Motherboard for :
  - image processing : image A → image B
  - data analysis : image A → data
  - image understanding : image A → high level description output from image or data
- FPGA : Xilinx® Zynq™-7020 with ARM dual-core Cortex™-A9 and Artix™-7
- Memory : 512 MB
- Data interface : USB 3.0, GigE
- I/O : - Trigger In/Out, Synchro In/Out, Strobe Out
  - Opto-coupled inputs, TTL max 5V
  - Internal slot for Pmod board
- External power supply : Input AC 100-240V Output DC 12V / 2.5A

## Triggering

- Software / UDP
- External contact closure
- External TTL signal (max 5V)
- Other ProcImage
- Automatic image triggering (option)
- Automatic sound triggering (option)
- Other on request

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## EyeMotion software specifications

- Camcorder function : camera setup, acquisition, save, playback
- Save format : .eye, .mov, .avi, .bmp, .tiff, .png, .jpeg
- Quick save : .qye, save of video files in a few seconds
- Factory setting ROI* or user adjustable in size and position
- Setting of the HDR** parameters
- Histogram display
- Triggers management : triggers selection and setup
- Trigger setup : rising/falling edge, event marker
- Trigger position in the sequence : start, stop, delay before or after
- User adjustable display parameters: brightness, contrast, gamma, white point, black point
- Simultaneous displaying of synchronized videos
- Overlay of videos with opacity adjustment
- Selection of discontinuous frame ranges
- Compatible with Windows XP (SP3 required), Vista, 7, 8
- Supports native 32-bit and native 64-bit to handle memory spaces larger than 4 GB
- Software Development Kit (SDK) available on request
  * ROI: Region Of Interest        ** HDR: High Dynamic Range

## Options

- Scheduler : integrated software tool in EyeMotion to schedule video captures

- External cameras :
    - management of webcams compatible with the OpenCV library
    - management of IP camera JVC VN-H37U

- Smart triggers
    - automatic image triggering
    - automatic sound triggering

- Embedded image processing
    - image processing carried out in real time at high speed in the camera's FPGA
      · thresholding / binarization    · profile (surface), (edge), (center)    · multi centroid

- Post-processing (EyeMotion 2D)
    - graphical tools with dynamic overlay of data, text, shapes, images and films for manual tracking and reporting
    - calculation and export of positions, speeds, accelerations, lengths, angles
    - automatic recognition and tracking of blob markers
    - user configurable skeleton tracking

- HDK :
  Hardware Development Kit with drivers for DDR3, sensor and USB 3.0, example code included.
  Enable the implementation of embedded proprietary IP in the FPGA.

- Lens calibration : correction of lens image distortion[1]
[1] Camera and lens return is required as calibration takes place in the factory.

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## Related services

**FPGA programming service for development and implementing of custom IP\*.**

From your images and a description of your image processing needs, our study team can assess the feasibility of your requirement and send you a quote.
\* Intellectual Property

**Based on the ProcImage500-Eagle, custom high speed intelligent camera manufacturing.**
Please contact us.



## References order

Camera reference : **ProcImage500-Eagle**

- All options listed previously can be individually ordered.
- Camera options can be upgraded at any time.
- Graphical tools and EyeMotion2D can be provided as single license per seat.

## Items supplied with each camera

- "EyeMotion" software
- Camera licence
- 2.0 m length USB 3.0 cable,
  (USB type B male – USB type A male)
- Remote switch trigger with mini-jack connector 2.5 mm
- Power supply
- C-mount, F-mount
- Setup instructions

## Minimum recommended PC configuration

- 7200 rpm hard disk, or SSD
- For long duration recording, write speed > 330 MB/s
- 4 GB RAM
- > 2 GHz processor
- Windows 7
- USB 3.0 native interface

## Contact :

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