EureCard MULTI

Image Acquisition and Processing from Digital Cameras

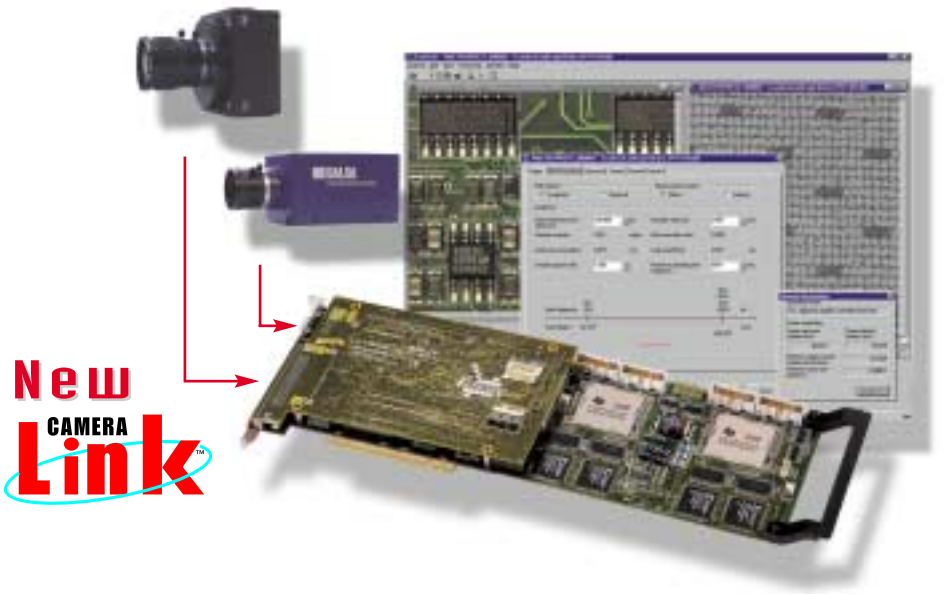
Through a choice of acquisition modules, the **EureCard Multi** provides image acquisition from line scan and area scan digital cameras.

The modular architecture of the Multi design allows three different versions: **Multi Express** (with two DSPs), **Multi Plus** (with one DSP) or **Multi** (without DSP). In addition, any version may be fitted with a **Camera Link**, a **Digital 32** or **Digital 16** input module.

Unique to the EureCard Multi is the **DuoCam mode**. It allows you to acquire images simultaneously from two unsynchronized cameras connected to the board. Cameras may even be different !

- **Camera Link, 16 and 32-bit LVDS or RS-422 input at 40 MHz**
- **Compatible with line-scan and area-scan, monochrome and RGB digital cameras**
- **DuoCam mode: acquisition from two independent cameras in parallel**
- **Optional DSPs for fast image processing (shading correction, color pre-processing, ...)**
- **PCI bus interface with bus mastering and real-time image transfer to PC memory**

Libraries, DLLs and ActiveX Controls included



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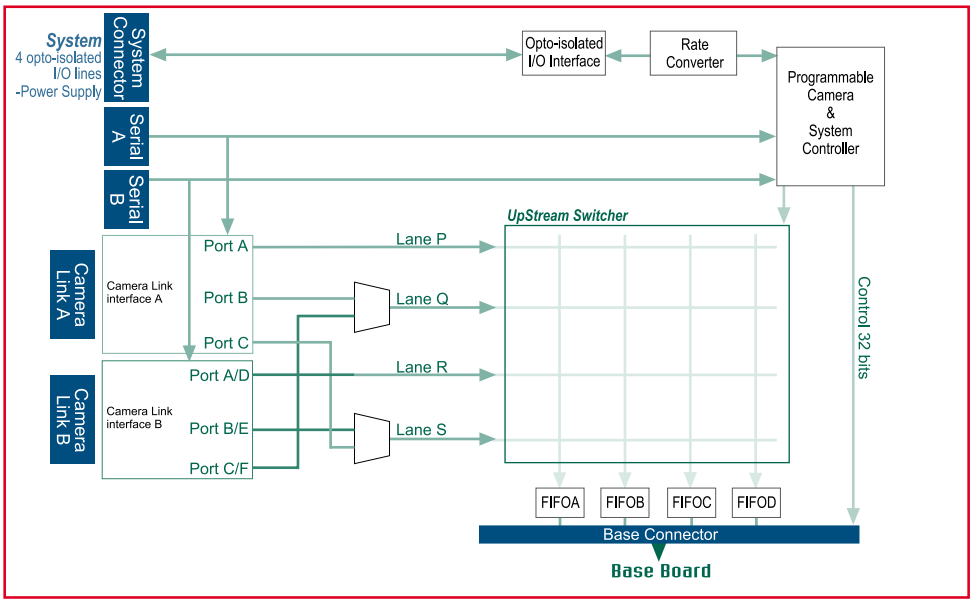
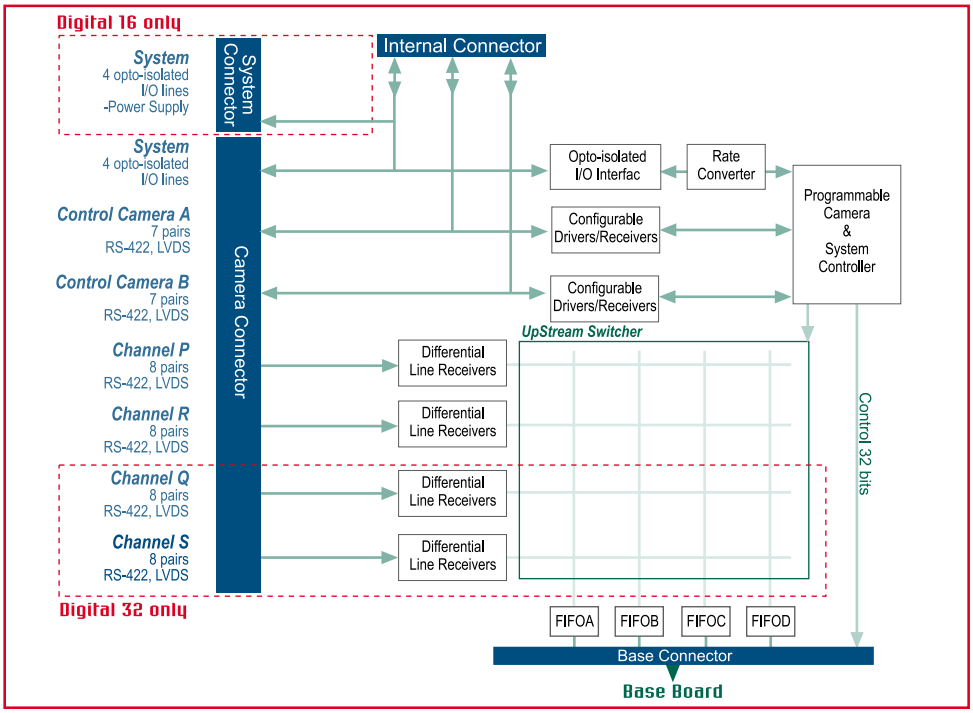
BLOCK DIAGRAM

Input modules

Dual Camera Link

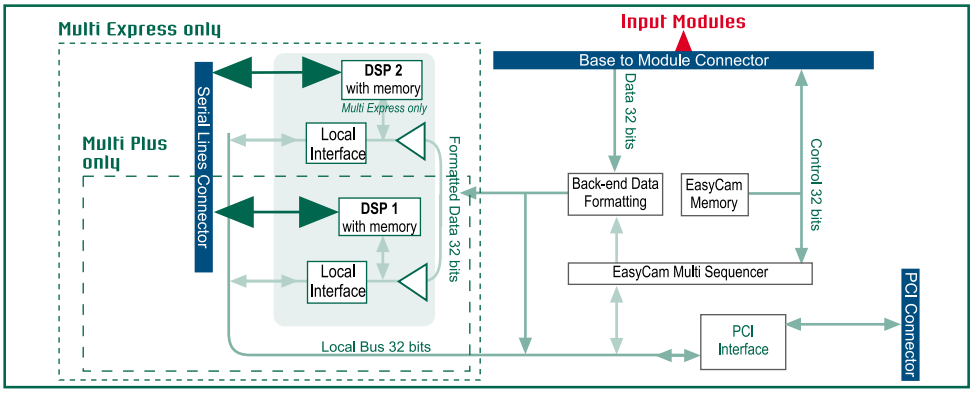


Digital 16
Digital 32



Base boards

MULTI
MULTI Express
MULTI Plus



SYSTEM ARCHITECTURE

Select your input module

p 2

Dual Camera Link Input Module

For Camera Link digital cameras

Digital 16 Input Module

16 digital video input lines

Digital 32 Input Module

32 digital video input lines

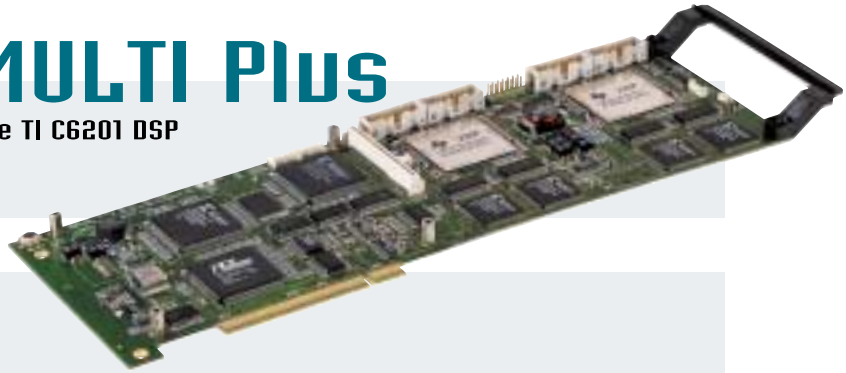
Select your base board

p 3

MULTI

MULTI Plus

One TI C6201 DSP



MULTI Express

Two TI C6201 DSPs

SpeedyTools - MultiCam - Dispatcher boards

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INPUT MODULES: Dual Camera Link . Digital 16 . Digital 32

Dual Camera Link Input Module

- **Two "Camera Link" compliant connectors**
- Up to **40 MHz** pixel clock
- **Three DB9 connectors** on an extra bracket
  - One system connector for acquisition trigger and strobe (four opto-isolated I/O lines)
  - Two serial connectors duplicating the camera serial control ports
- **Line scan and area scan cameras supported**

Type of camera		1 camera	2 cameras
Single-tap	1 x 8 bits	V	V (DuoCam Mode)
	1 x 10 bits	V	V (DuoCam Mode)
	1 x 12 bits	V	V (DuoCam Mode)
Dual-tap	2 x 8 bits	V	V (DuoCam Mode)
RGB	3 x 8 bits	V	V (Multiplexed)
Four-tap	4 x 8 bits	V	-

DuoCam Mode: see on page 8, Camera Control.

Digital 16 Input Module

- **16 differential digital video input lines with RS-422 or LVDS levels**
- Up to **40 MHz** pixel clock
- **68-pin Micro-SubD camera connector** including camera control signals (for two cameras), 16 data lines, 4 opto-isolated trigger/strobe lines and an isolated 5V power supply
- **DB 9 system connector** including 4 opto-isolated trigger/strobe lines and an isolated 5V power supply
- **Line scan and area scan cameras supported**

Type of camera		1 camera	2 cameras
Single-tap	1 x 8 bits	V	V (DuoCam Mode)
	1 x 10 bits	V	-
	1 x 12 bits	V	-
Dual-tap	2 x 8 bits	V	-

DuoCam Mode: see on page 8, Camera Control.

Digital 32 Input Module

- **32 differential digital video input lines with RS-422 or LVDS levels**
- Up to **40 MHz** pixel clock
- **100-pin Micro-SubD camera connector** including camera control signals (for two cameras), 32 data lines, 4 opto-isolated trigger/strobe lines and an isolated 5V power supply
- **Line scan and area scan cameras supported**

Type of camera		1 camera	2 cameras	3 cameras	4 cameras
Single-tap	1 x 8 bits	V	V (DuoCam Mode)	V *	V *
	1 x 10 bits	V	V (DuoCam Mode)	-	-
	1 x 12 bits	V	V (DuoCam Mode)	-	-
Dual-tap	2 x 8 bits	V	V (DuoCam Mode)	-	-
RGB	3 x 8 bits	V	-	-	-
Four-tap	4 x 8 bits	V	-	-	-

* Only for line scan cameras. Synchronized 2 by 2.

DuoCam Mode: see on page 8, Camera Control.

BASE BOARDS : MULTI . MULTI Plus . MULTI EXPRESS

Architecture

The EureCard Multi base board is available in three versions: Multi Express, Multi Plus and Multi.
The Multi Plus and Multi Express respectively incorporate one and two 200 MHz TMS320C6201 DSPs from Texas Instruments.
The Multi has no embedded processor and relies on the host Pentium to process images.

	DSPs	DSPs Memory
EureCard MULTI Express	2	32 Mbyte
EureCard MULTI Plus	1	16 Mbyte
EureCard MULTI	-	-

Each processor is linked to its own **16 Mbyte SDRAM memory bank** by a dedicated **high-speed 132 Mbyte/s bus**. These two buses carry video data from the acquisition unit to every DSPs or to its associated SDRAM. Both DSPs can work and transfer data independently, effectively doubling the system's processing power.

On-the-fly image processing

The DSPs process internally the video data in a **"stream" operating mode** and transfer it immediately to the PC memory. The data is transferred without being stored in the EureCard Multi embedded memory to provide an instantaneously **on-the-fly image data processing**.

Power, flexibility and easy-of-use

Compared to classical hardware processing architectures, **the Multi offers a highly flexible solution**.

The **MultiCam driver** introduces the concept of **virtual Processors** that can freely be created by users and assigned tasks. Each virtual processor is able to process a stream of pixels coming from a camera, **on the fly**, without delaying data transfer to PC memory. Users can easily configure the processing path, independently for each channel. And this requires **absolutely no programming** !

Two libraries of virtual processors are now available: **SpeedyWeb** and **SpeedyColor**. Other DSPs libraries are already under development. The Multi Express offers 3200 MIPS of processing power for **real-time image processing**. The Speedy libraries are highly optimized to take advantage of the C6201 DSPs parallel processing architecture.

DSPs programming

Advanced users are allowed **to download their own code to the DSPs memory**. The EureCard Multi is compatible with Texas Instrument's Code Composer Studio development environment. It is fitted with a JTAG port compatible with the XDS510 emulator from TI or equivalent, offering source code level debugging and profiling, in relation with TI's DSPs/BIOS library.

DSPs-Based Image Processing Tools

SpeedyTools

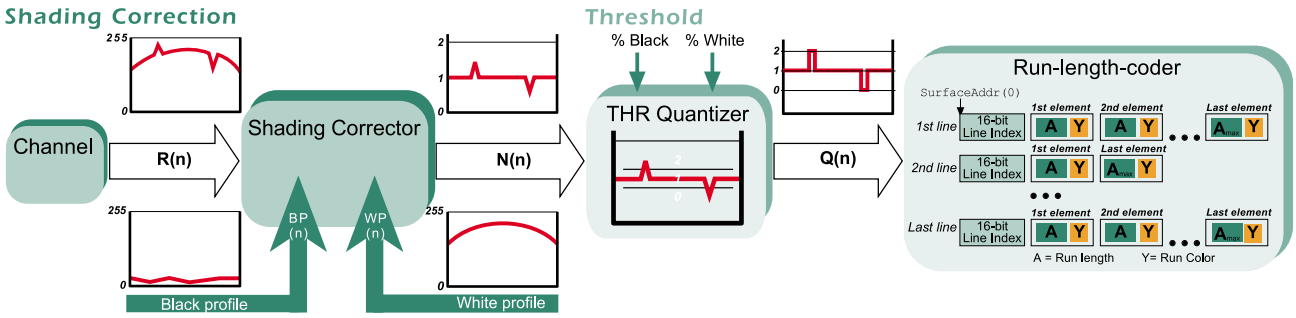
SpeedyTools is a range of DSPs based image processing tools. Two libraries are already available : SpeedyWeb and SpeedyColor.

SpeedyWeb: line-stream image processing for web inspection applications

SpeedyWeb is the first member of Euresys' new generation DSPs-based image processing tools. **SpeedyWeb** is a line-stream library. It is able to process images coming from **line-scan cameras** on the fly, without delaying their transfer to PC memory.

The following image pre-processing functions are available in SpeedyWeb:

- **Shading correction**
  Including compensation of lighting spatial non-uniformities, camera Fixed Pattern Noise (FPN) and camera Photo-Response Non-Uniformities (PRNU). This process is carried out through the acquisition of two reference profiles (a white reference profile and a black reference profile). It drastically improves the quality of the images acquired by the Multi, improving their visual quality and facilitating their processing.
- **Thresholding**
  With up to two levels, dividing the gray scales into three classes: white, neutral and black.
- **Run-Length Coding**
  The Run-Length Coding compresses the image by detecting the position of the gray scale transitions and transmitting them as a table to the PC. The result is directly compatible with Euresys' eVision **EasyObject** library. It is notably useful in **surface inspection applications**.



The SpeedyWeb functions offer the following performance:

Processor	Performance
Shading correction / Thresholding (with 3 levels) / Run-length-coding	**80 Mpixel/s** (8 bit pixels – Multi Plus, 1 DSP)
Shading correction / Result normalization	**40 Mpixel/s** (8 bit pixels - Multi Plus - 1 DSP) **2 x 40 Mpixel/s** (8 bit pixels - Multi Express - 2 DSPs)

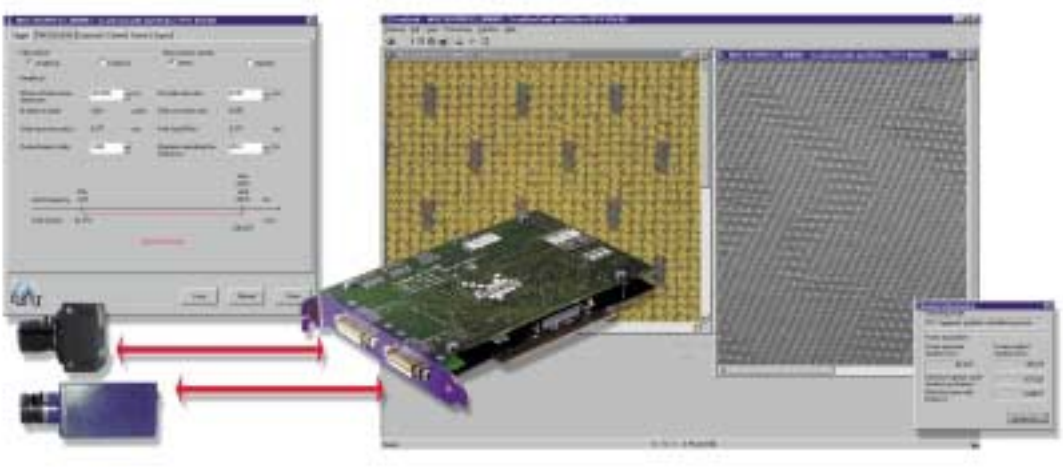
SpeedyColor: Bayer pattern to RGB conversion

SpeedyColor is able to **transform Bayer-pattern images into full RGB** color images on the fly, during their acquisition. The process is carried out through precise interpolation of the input image. Three Look-up-tables (LUTs), one for each color component, are incorporated in the data path, providing an easy way to perform white balance or apply a gain or gamma correction to the image.
SpeedyColor works in real time with 20 MHz area-scan Bayer-pattern color cameras.

Software Access: MultiCam Driver

MultiCam Driver

The EureCard Multi is delivered with the new **MultiCam driver**. This driver drastically simplifies the acquisition of images coming from multiple cameras connected to one or more Multi boards.



The **MultiCam driver** allows you to define **channels** linking cameras to buffers in PC memory. Each channel knows all the acquisition parameters (camera type, image format and size, …).

Channels can be controlled individually, and activated simultaneously, providing a convenient way to manage the **DuoCam** mode. All camera parameters are stored in legible and editable CAM files. They can also be modified individually from your program.

The **MultiCam driver** for the Multi is compatible with Windows 98, ME, 2000 and NT. It is delivered as **libraries**, **DLLs** and **ActiveX controls**.

Camera Dispatcher Boards

Dispatcher 37 & Dispatcher 68 for Digital input modules

Dispatcher 68

When it comes to connecting several digital cameras to a PCI board, wiring and connection problems quickly become significant.

Euresys provides a convenient solution through the use of external "dispatcher" boards adapted to cameras. Dispatchers are small boxes serving as interconnection units. On one end, they provide a pin-to-pin connection with the high-density connector of the **Digital 16 or Digital 32** input module. On the other end, they provide a set of standard connectors adapted to cameras. Standard cables linking Multi's input modules to dispatcher boards are available.

The Dispatcher 37 provides two DB37 connectors (for cameras A and B) and a DB9 system connector.

The Dispatcher 68 provides two high-density AIA compliant 68-pin connectors (for cameras A and B), a DB9 system connector, and two DB9 serial connectors. It is also able to translate the RS-422 serial lines of the Adimec MX12P camera into standard RS232 levels.

Camera Control

DuoCam Mode

The EureCard Multi supports the simultaneous acquisition from **two independent cameras** (A and B), each camera having its own control signals, clock, trigger and strobe lines. This operating mode is called the **DuoCam** mode. It makes the **EureCard Multi a perfect choice for multi-point inspection applications**. It is really like having two frame grabbers in one PCI slot of your PC. Simultaneous and independent triggering of the cameras is perfectly supported. **Both cameras may even be different.** Then, the combination of one line-scan and one area-scan camera is possible.
When using 8-bit line-scan cameras and the Digital 32 Input Module, **four cameras** can be used simultaneously. They are then synchronized two by two. This operating mode is ideal for ultra-wide web inspection applications.

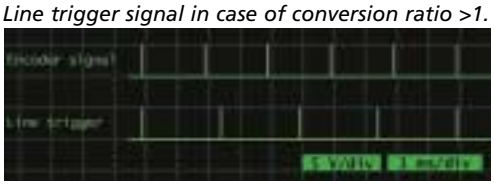
Extensive line scan camera control

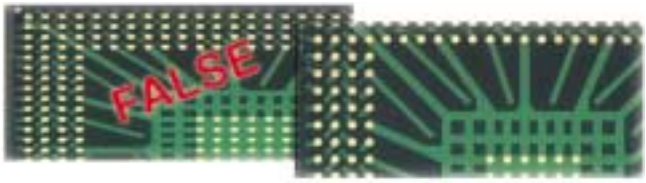
The Multi timing generation machine includes a lot of features that will help you to integrate it into line scan applications:

- **A programmable "rate converter"** allows you to accommodate the frequency of the encoder pulses. The line acquisition rate may be either higher or lower than the encoder pulse rate (the ratio is programmable with a 0.1% precision), thus allowing you to keep the same encoder for several applications and always get a **perfect square-pixel image**.

Line trigger signal in case of conversion ratio < 1.

Line trigger signal in case of conversion ratio >1.





To avoid this and get a perfect square pixel image, use an off-the-shelf encoder and the EureCard Multi Rate Converter !

- **Line scan cameras may be used in "Page Mode" or in "Web Mode":**
  In **Page Mode**, the page trigger event triggers the acquisition of a given number of lines. The system thus behaves as a 2D acquisition system. The page trigger may be internal (software command) or external (Frame Trigger input). There is a programmable delay between the page trigger event and the actual start of the page.
  In **Web Mode**, the system continuously acquires and transfers lines from the camera, without ever dropping a line.

Pixel formatting

The Multi is fitted with a flexible and powerful "Pixel Formatter" which reorders data coming from the camera. It ensures that the image acquired in PC memory has a suitable format for processing.

- Images from different cameras are stored in separate memory buffers.
- Pixels from multi-tap cameras are properly reordered.
- The format of the images coming from color cameras may be packed (R, G and B components packed in one buffer) or planar (separated into three planes).
- 8-bit, 10-bit, 12-bit, 14-bit and 16-bit pixels are supported.

PCI interface

Images (and even sequences of images) are transferred to PC memory in real-time. The transfer takes place **in parallel with the acquisition**, without interrupting the Pentium, thus freeing the processor for any other task.
There is no need to wait for the transfer of the image from the frame grabber's memory to PC memory and an image can be processed while the system is acquiring the next one.
The user's program is informed of the end of the transfer through an interrupt and the call of a user-defined callback function. Any application memory space reserved by the user may be used to receive the image.

LIST OF SUPPORTED CAMERAS

		Sensor Size	Data channels	Line/Frame rate	Average pixel rate (Mps)*	Input module required
Adimec	MX12P/8423	1024 x 1024	1 x 12	15 Fps	17.3	LVDS
	MX12P/8443	1024 x 1024	1 x 12	30 Fps	34.6	LVDS
Basler	A101/A101p/A101c/A101pc	1300 x 1030	1 x 8 or 2 x 8	11.75 Fps	12.75	LVDS
	A201/A201c	1008 x 1018	2 x 8	33 Fps	35.5	LVDS
	A201b/A201bc	1008 x 1018	2 x 8	33 Fps	35.5	Camera Link
	L101-1K	1024 x 1	1 x 8 or 2 x 8	18.8 kHz	20	LVDS
	L101-2K	2048 x 1	1 x 8 or 2 x 8	9.6 kHz	20	LVDS
	L102-1K	1024 x 1	1 x 8 or 2 x 8	30.2 kHz	32	LVDS
	L102-2K	2048 x 1	1 x 8 or 2 x 8	15.3 kHz	32	LVDS
	L103-1K	1024 x 1	1 x 8 or 2 x 8	36 kHz	40	LVDS
	L103-2K	2048 x 1	1 x 8 or 2 x 8	18 kHz	40	LVDS
	L104-1K	1024 x 1	2 x 8	58 kHz	62.5	LVDS
	L104-2K	2048 x 1	2 x 8	29.5 kHz	62.5	LVDS
	L201	4096 x 1	1 x 8 or 2 x 8	4.8 kHz	20	LVDS
	L202	4096 x 1	1 x 8 or 2 x 8	7.4 kHz	32	LVDS
	L203	4096 x 1	1 x 8 or 2 x 8	9.6 kHz	40	LVDS
	L301bc	2098 x 3	3 x 8	9 kHz	60	Camera Link
Dalsa	CL-E2-0512A	512 x 1	1 x 8	31 kHz	20	RS-422
	CL-E2-1024A	1024 x 1	1 x 8	17 kHz	20	RS-422
	CL-E2-2048A	2048 x 1	1 x 8	8 kHz	20	RS-422
	SP-1X-01K30	1024 x 1	1 x 8	27.6 kHz	30	LVDS
	SP-1X-01K40	1024 x 1	1 x 8	36.8 kHz	40	LVDS
	SP-1X-02K30	2048 x 1	1 x 8	14.1 kHz	30	LVDS
	SP-1X-02K40	2048 x 1	1 x 8	18.8 kHz	40	LVDS
	SP-1X-05H30	512 x 1	1 x 8	52.8 kHz	30	LVDS
	SP-1X-05H40	512 x 1	1 x 8	70.4 kHz	40	LVDS
	TR-3X-01K25	1024 x 3	3 x 8	21 kHz	25	LVDS
	TR-3X-02K25	2048 x 3	3 x 8	11 kHz	25	LVDS
	CL-CB-0512W	512 x 1	1 x 8	34 kHz	20	RS-422
	CL-CB-1024W	1024 x 1	1 x 8	18 kHz	20	RS-422
	CL-CB-2048W	2048 x 1	1 x 8	9.4 kHz	20	RS-422
	LY11-05H40	512 x 1	1 x 8	70.4 kHz	40	Camera Link
Hamamatsu	C7300-10-12NRU	1280 x 1024	1 x 12	13.2 Fps	17.6	RS-422
Hitachi	KP-F100	1300 x 1030	1 x 10	12 Fps	16.3	RS-422
	KP-F110	1024 x 1024	2 x 10	30 Fps	34.6	RS-422
Ikegami	SKC-130	1300 x 1030	1 x 10	15 Fps	12.75	RS-422
JAI	CV-L103	2048 x 3	3 x 8	3.4 kHz	7.2	LVDS
	CV-L105	2048 x 3	3 x 8	14.2 kHz	30	LVDS
	CV-M4(CL)/-M7(CL)	1280 x 1024	1	24 Fps	32	LVDS (Camera Link)
Kodak / Roper	ES1.0 / ES1.0/TH	1008 x 1018	2 x 8	30 Fps	32	LVDS
	ES1.0/10 bit	1008 x 1018	2 x 10	30 Fps	32	LVDS
	ES1.0/SC	1008 x 1018	1 x 8	15 Fps	16	LVDS
	ES310	648 x 484	2 x 8	85 Fps	27.6	LVDS
	ES4.0/12-bit	2048 x 2048	2 x 12	8 Fps	77.2	LVDS
	ES4.0/8-bit	2048 x 2048	2 x 8	15 Fps	77.2	LVDS
	Megaplus 1.4i	1317 x 1035	1 x 8	6.9 Fps	9.4	LVDS
	Megaplus 1.4i/HF	1317 x 1035	1 x 8	10.2 Fps	14.2	LVDS
	Megaplus 1.6i/...AB/...TEC	1534 x 1024	1 x 10	5.5 Fps	8.6	LVDS
	Megaplus 4.2i	2029 x 2044	1 x 8	2.1 Fps	8.5	LVDS
	Megaplus 4.2i/10	2029 x 2044	1 x 10	2.1 Fps	8.5	LVDS
	Megaplus 4.2i/HF	2029 x 2044	1 x 8	2.9 Fps	12.8	LVDS
	Megaplus 6.3i / ...10	3072 x 2048	1 x 10	1.3 Fps	8.5	LVDS
Lord Ingéniérie	CNL2048V	2048 x 1	1 x 8	2.3 kHz	5	RS-422
	CNL2048RPV	2048 x 1	1 x 8	930 Hz	2	RS-422
	CNL5150V	5150 x 1	1 x 8	3.7 kHz	20	RS-422
Pulnix	TM-1001	1008 x 1017	1 x 8	15 Fps	15.9	RS-422
	TM-1020-15(CL)	1008 x 1018	1 x 8	15 Fps	16.1	LVDS (Camera Link)
	TM-1020-30(CL)	1008 x 1018	1 x 8	30 Fps	32.2	LVDS (Camera Link)
	TM-1040	1024 x 1024	1 x 10	30 Fps	32.2	RS-422
	TM-1300	1300 x 1030	1 x 10	11.9 Fps	16.1	RS-422
	TM-6710	648 x 484	2 x 8	120 Fps	39.5	LVDS
	TM-9701	768 x 484	1 x 8	30 Fps	32.2	RS 422
	TMC-6700CL	648 x 484	3 x 8	60 Fps	20.4	Camera Link
	TMC-1000CL	1008 x 1018	3 x 8	15 Fps	15.9	Camera Link
Thomson	TH78CA13/TH78CE13	1024 x 1	1 x 12	38 kHz	40	RS-422
	TH78CA14/TH78CE14	2048 x 1	1 x 12	19 kHz	40	RS-422
	TH78CA15/TH78CE15	4096 x 1	1 x 12	9.5 kHz	40	RS-422
	TH78CD13/TH78CH13	1024 x 1	1 x 12	38 kHz	40	LVDS
	TH78CD14/TH78CH14	2048 x 1	1 x 12	19 kHz	40	LVDS
	TH78CD15/TH78CH15	4096 x 1	1 x 12	9.5 kHz	40	LVDS
TVI	Pricolor 1024 R	1024 x 3	3 x 8	17 kHz	20	RS-422
	Pricolor 1024 R	1024 x 3	1 x 10	7 kHz	8.3	RS-422
	Pricolor 2048 R	2048 x 3	3 x 8	9.2 kHz	20	RS-422
	Pricolor 2048 R	2048 x 3	1 x 10	3.9 kHz	8.3	RS-422
SVS-Vistek	SVS 084	640 x 480	1 x 10	60 Fps	-	LVDS
	SVS 085 S	1280 x 1024	1 x 10	12 Fps	-	LVDS
	SVS 085 F	1280 x 1024	1 x 10	25 Fps	-	LVDS
	SVS 085 Color S	1280 x 1024	1 x 8	12 Fps	-	LVDS
	SVS 085 Color F	1280 x 1024	1 x 8	25 Fps	-	LVDS
	SVS 204 S	1024 x 768	1 x 10	20 Fps	-	LVDS
	SVS 204 F	1024 x 768	1 x 10	40 Fps	-	LVDS
	SVS 204 Color S	1024 x 768	1 x 8	20 Fps	-	LVDS
	SVS 204 Color F	1024 x 768	1 x 8	40 Fps	-	LVDS

This list is correct at time of printing. For up-to-date information, please consult our web site.
* The "average pixel rate" is the camera's pixel rate averaged during one line.
Euresys will not be held liable for errors and omissions in this table.

ORDERING INFORMATION

MULTI FRAME GRABBERS

Base module

PRODUCT NAME	PART NUMBER
EureCard Multi	1171
EureCard Multi Plus	1172
EureCard Multi Express	1174

Input module

PRODUCT NAME	PART NUMBER
Dual Camera Link Input Module	1183
Digital 16 (RS-422 inputs and 8K FIFO)	1181-422
Digital 16 (LVDS inputs and 8K FIFO)	1181-644
Digital 32 (RS-422 inputs and 8K FIFO)	1182-422
Digital 32 (LVDS inputs and 8K FIFO)	1182-644

DISPATCHERS FOR MULTI

PRODUCT NAME	PART NUMBER
Dispatcher Dalsa	1240
Dispatcher 37	1223
Dispatcher 68	1260

CABLES FOR MULTI

Cables available for most supported cameras listed on page 9.

For more information: info@euresys.com

SpeedyTools

PRODUCT NAME	PART NUMBER
SpeedyWeb License	2401
SpeedyWeb Additional License	2401-Add
SpeedyColor License	2402
SpeedyColor Additional License	2402 -Add

Euresys
14, avenue du Pré Aily, B-4031 Angleur, BELGIUM
Phone:+32 (4) 367 72 88 Fax: +32 (4) 367 74 66
US Office
Toll free: 800 995 8009 Phone: 619 444 8300
info@euresys.com **www.euresys.com**

EURESYS Excellence in vision

Your distributor

Opto Vision France - Z.I. Thibaud,
9 rue Boudeville, 31104 Toulouse cedex 1
Tél. 05 61 76 51 11 - Fax 05 61 76 51 52