GRABLINK™ series

High-Speed Digital Camera Link Image Acquisition Boards

GRABLINK Avenue™

GRABLINK Express™

GRABLINK Quickpack CFA PCIe™

GRABLINK™ series

GRABLINK Value™ – GRABLINK Value cPCI™ – GRABLINK Avenue™
GRABLINK Express™ – GRABLINK Expert 2™ – GRABLINK Expert 2 cPCI™
GRABLINK Quickpack ColorScan™ – GRABLINK Quickpack CFA PCIe™

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The GRABLINK™ series Comparison Chart

	GRABLINK Value	GRABLINK Value cPCI	GRABLINK Avenue	GRABLINK Express	GRABLINK Expert 2	GRABLINK Expert 2 cPCI	GRABLINK Quickpack ColorScan	GRABLINK Quickpack CFA PCIe
Form factor	32-bit, 33 MHz PCI Full height, half length	64-bit, 66 MHz cPCI 6U/4HP	64-bit, 66 MHz PCI Full height, half length	x1 PCI Express Full height, half length	64-bit, 66 MHz PCI Full height, half length	64-bit, 66 MHz cPCI 6U/4HP	64-bit, 66 MHz PCI Full height, half length	x4 PCI Express Full height, half length
Camera Link configuration	Base	Base	Base	Base *PoCL Safe Power*	Base, dual-Base, Medium	Base, dual-Base, Medium	Base	Base *PoCL Safe Power*
Tap demultiplexing incl. tap reversal	✔	✔	✔	✔	✔	✔	✔	✔
Max. pixel-clock frequency	24 bits @ 60 MHz	24 bits @ 60 MHz	24 bits @ 85 MHz	24 bits @ 85 MHz	48 bits @ 60 MHz	48 bits @ 60 MHz	24 bits @ 60 MHz	24 bits @ 85 MHz
Gray scale	✔	✔	✔	✔	✔	✔	-	-
Color	✔	✔	✔	✔	✔	✔	✔	✔
Area scan	✔	✔	✔	✔	✔	✔	-	✔
Line scan	✔	✔	ADR	ADR	✔	✔	✔	-
Max. delivery bandwidth	90 MB/s	90 MB/s	240 MB/s	180 MB/s	240 MB/s	240 MB/s	240 MB/s	320 MB/s
On-board memory	8-MB	8-MB	32-MB	32-MB	16-MB	16-MB	128-MB	128-MB
Pre-processing *- Input images* *- Pre-processing functions* *-Max. processing rate*	***LUTs** 3x (8-bit x 8-bit) for R, G, B*	***LUTs** 3x (8-bit x 8-bit) for R, G, B*	-	-	-	-	***For color line-scan inspection** 3 x 8-bit* ***Scan delay** compensation* ***Shading** correction* ***LUTs** 3x (8-bit x 8-bit) for R, G, B* ***White** balance* *Up to 50MPixels/s*	***For color area-scan inspection** 8-bit, 10-bit or 12-bit* ***Bayer** decoding* ***Luminance** blender* ***LUTs** 4x (16-bit x 16-bit) for R, G, B, Y* *Automatic **white** balance* *Up to 80MPixels/s*
I/O electrical style *-system functions-*	**4 externally**	**4 externally**	**9 internally & externally**	**9 internally & externally**	**26 on an I/O board**	**26 externally**	**2 externally**	**9 internally & externally**
Isol. multi-mode bidirectional I/O* & isol. 5V power supply *-IN (Trigger/Line trigger) OUT (Strobe)-*	2	2	2	2	4	4	2	2
Non-isol. TTL input *-Trigger/Line trigger-*	1	1	-	-	3	3	-	-
Non-isol. TTL output *-Strobe-*	1	1	-	-	3	3	-	-
Non-isol. bidirectional CMOS I/O	-	-	-	-	16	16	-	-
Non-isol. universal differential input** *-Trigger/Line-*	-	-	2	2	-	-	-	2
Isol. contact output *-Strobe-*	-	-	1	1	-	-	-	1
Non-isol. bidirectional TTL I/O *-Trigger/Line trigger-*	-	-	4	4	-	-	-	4
5V Power supply	✔	✔	✔	✔	✔ (2)	✔ (2)	✔	✔
12V Power supply	✔	✔	✔	✔	✔	✔	✔	✔

***Input:** Isolated TTL, Isolated 12V. **Output:** Isolated TTL, Isolated Open Collector, Isolated Open Emittor. **LVDS and more

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The GRABLINK™ series

CAMERA Link® REGISTERED PRODUCT

GRABLINK Value™

GRABLINK Avenue™

GRABLINK Expert 2™

GRABLINK Express™

GRABLINK QuickPack ColorScan™

GRABLINK QuickPack CFA PCIe™

GRABLINK Value cPCI™

GRABLINK Expert 2 cPCI™

High-Performance LINE-SCAN and AREA-SCAN Applications

Flexible and Reliable LINE-SCAN Acquisition

Camera modes The Grablink series interfaces to **state-of-the-art Camera Link line-scan cameras** with **line rate** and **exposure control**. Free running cameras are supported as well.

Continuous web scanning The «**web mode**» allows inspecting a continuously moving surface without losing a single line.

Successive object scanning In «**page mode**», a Grablink acquires a set of consecutive lines constituting a 2D image. The acquisition starts when the object enters the camera field of view, as signaled by an external trigger.

Motion encoder When the observed web or object moves at a variable speed, the frame grabber imposes a camera scanning rate derived from a motion encoder. **This guarantees a fixed pixel aspect ratio**. **Perfect square pixels** are achievable. A built-in rate converter of the Grablink boards defines any ratio between the camera scanning rate and the encoder pulse rate with 1/1000 resolution. Thus, an off-the-shelf encoder can serve several applications. The exposure control feature guarantees a **constant sensitivity** despite the speed variation.

ADR Technology™*

Simple and reliable LINE-SCAN acquisition with constant lighting sensitivity and line rate

In many applications, a **line-scan camera** has to be operated at a **constant cycling rate** in order to maintain a constant sensitivity. The **Grablink Avenue** and the **Grablink Express implement ADR***, **a unique downweb resampling feature**, yielding a defined aspect ratio irrespective of web speed variations, even without an electronic shutter on the camera.

A built-in rate converter accommodates an off-the-shelf motion encoder to control the line acquisition process, enabling any **programmable aspect ratio**, **including perfect square pixels**.

ADR* makes the most of the line-scan camera, as the sensitivity is not impaired by the shuttering.

➢ ***Download the "About ADR Technology" flyer from our web site: www.euresys.com.***

Full Support of AREA-SCAN Acquisition

Camera modes Features such as **asynchronous reset, exposure control, strobe lighting** often required in industrial applications are available on the Grablink series. The synchronous mode is also supported.

Trigger and exposure control An external signal can be sent to the frame grabber to trigger the acquisition. The Grablink series is capable of consistently controlling the exposure time and the illumination.

Camera tap structure For any tap structure, a Grablink delivers a **re-ordered bitmap image** to the PC memory. **Tap-reversal** is supported. With the **multiplex tap** technique, several taps are interleaved over Camera Link as long as the combined data rate remains below the pixel clock frequency specified for the board.

*Patent granted

Main Features

- ***Acquisition:***
  Up to 24-bit / 48-bit at maximum 85 MHz
  Camera Link configurations: Base, dual Base or Medium
  Support of LINE-SCAN and AREA-SCAN cameras
  Multiple taps, tap reversal, tap multiplex
- ***Large on-board memory***
- ***Asynchronous reset, exposure control and I/O lines*** *-trigger & strobe-*
- ***Camera Link serial line configurable as an additional PC COM port***
- ***MultiCam drivers for Windows® and Linux***

The Grablink series is a range of **high-speed** PCI, PCI Express and Compact PCI frame grabbers for **line-scan or area-scan digital Camera Link cameras**. State-of-the-art cameras are easily connected with off-the-shelf Camera Link compliant cables. The Grablink series is ideal for industrial applications such as inspection of **high-speed moving objects, web inspection or high-resolution acquisition**.



Serial Control of Camera

The Grablink series supports the Camera Link pseudo **RS-232 serial line**. The application software can use the Camera Link API functions to control the camera. Alternatively, the serial line can be **configured as an additional PC COM port** ensuring interoperability with existing camera control software.

Bus Mastering

All Euresys frame grabbers are **PCI bus mastering** agents that directly store the acquired images into the PC physical memory without CPU involvement. As a **unique feature**, a Euresys board automatically recovers the **scatter-gather** virtual memory mapping to present the data as a regular bitmap image in a user allocated memory buffer.

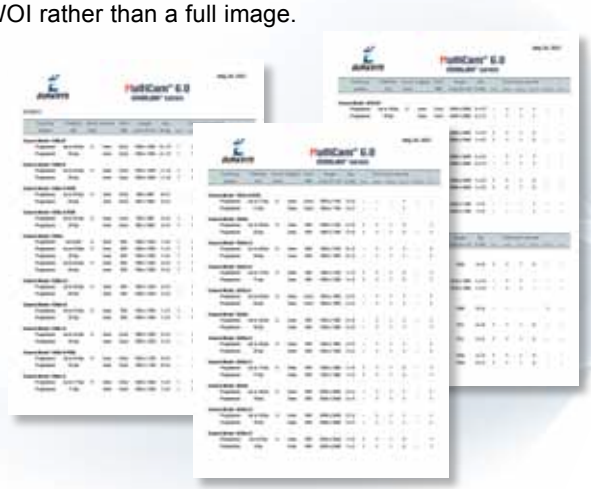
Windows Of Interest (WOI) Support

The Grablink series seamlessly support the acquisition of a WOI rather than a full image.

Interfaced Cameras

The Grablink series interfaces an impressive choice of different cameras.

➢ *An up-to-date list is available on the Interfacing Cameras page on www.euresys.com.*



GRABLINK Value™

Cost-Effective Camera Link Acquisition

***Base configuration** -24-bit at 60 MHz-*
8-MB on-board memory
***Form factors: Conventional PCI** 32-bit 33 MHz bus*
***Compact PCI** 6U/4HP 64-bit 66 MHz bus*

The **Grablink Value** is an affordable Camera Link frame grabber for **cost-effective industrial applications**. The Grablink Value is recommended for **single-camera systems**.

Support of the Base Configuration

CAMERA COMPATIBILITY		Monochrome or Bayer		Color RGB
		single-tap	dual-tap	single-tap
Tap configuration		Base_1T8, Base_1T10, Base_1T12, Base_1T14, Base_1T16	Base_2T8, Base_2T10, Base_2T12	Base_1T24
Camera Link configuration	Base	1 tap x (8-10-12-14-16 bits)	2 taps x (8-10-12 bits)	1 tap x (24 bits)

4 I/O Lines Available on an External DB9 Connector

I/O electrical style
- 2 isolated multi-mode bidirectional I/O and associated isolated 5V power supply
  - Input: isolated TTL, isolated 12V
  - Output: isolated TTL, isolated open collector, isolated Open Emittor
- 1 non-isolated TTL input
- 1 non-isolated TTL output
- 5V and 12V power supplies

I/O electrical style and function
- TTL trigger or page trigger input
- Opto-isolated trigger or page trigger input
- TTL strobe output
- Opto-isolated strobe output
- TTL line trigger or encoder input
- Opto-isolated line trigger or encoder input

GRABLINK Avenue™

Ultra-Fast Camera Link Acquisition

***Base configuration** -up to 24-bit at 85 MHz-*
***Full support of AREA-SCAN cameras** -asynchronous reset and exposure control-*
***Simple and reliable LINE-SCAN acquisition** -ADR Technology™-*
32-MB on-board memory
***Form factor: Conventional PCI** 64-bit, 66 MHz bus, 3V/5V signaling*

The **Grablink Avenue** is an ultra-fast PCI frame grabber for **line-scan or area-scan digital Camera Link cameras**. Grablink Avenue is a high-performance **64-bit, 66 MHz PCI bus** board acquiring images from one camera in the Camera Link Base configuration. This board acquires the 24-bit data, with any tap structure, at the **maximum speed of 85 MHz** allowing to be interfaced to the fastest cameras.

Support of the Base Configuration

CAMERA COMPATIBILITY		Monochrome or Bayer			Color RGB
		single-tap	dual-tap	quad-tap	single-tap
Tap configuration		Base_1T8, Base_1T10, Base_1T12, Base_1T14, Base_1T16	Base_2T8, Base_2T10, Base_2T12, Base_2T14B2, Base_2T16B2	Base_4T8B2	Base_1T24, Base_1T24B3, Base_1T30B2, Base_1T36B2, Base_1T36B3, Base_1T42B2, Base_1T42B3, Base_1T48B2, Base_1T48B3
Camera Link configuration	Base	1 tap x (8-10-12-14-16 bits)	2 taps x (8-10-12 bits)	-	1 tap x (24 bits)
	Extended Base*	-	2 taps x (14-16 bits)	4 taps x (8 bits)	1 tap x (24-30-36-42-48 bits)

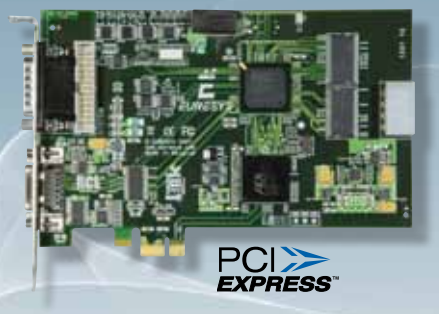
*Multiplex tap

9 Various I/O Lines available on an **external HD26 connector** and on an **internal 26-pin header connector**

I/O electrical style
- 2 isolated multi-mode bidirectional I/O and associated isolated 5V power supply
  - Input: isolated TTL, isolated 12V
  - Output: isolated TTL, isolated open collector, isolated open emittor
- 2 non-isolated universal differential inputs (LVDS and more)
- 1 isolated contact output
- 4 non-isolated bidirectional TTL I/O
- 5V and 12V power supplies

I/O electrical style and function
- TTL trigger or page trigger input
- LVDS trigger or page trigger input
- Opto-isolated trigger or page trigger input
- TTL strobe output
- Opto-isolated strobe output
- Fast opto-isolated strobe output
- TTL line trigger or encoder input
- Opto-isolated line trigger or encoder input

*Patent granted



GRABLINK Express™

Cutting-Edge PCI Express Camera Link Acquisition

Base Camera Link 1.2 configuration *-24-bit at 85 MHz-*
-Power over Camera Link compliant -PoCL-
Full support of AREA-SCAN cameras *-Asynchronous reset and exposure control-*
Simple and reliable LINE-SCAN acquisition *-ADR Technology™-*
32-MB on-board memory
Form factor: PCI Express *Full-height, half-length, x1*

The **Grablink Express** is at the cutting-edge of the Camera Link technology through the compliance with the new **standard 1.2 including PoCL** - Power over Camera Link-. It allows a single Camera Link cable to supply power to the camera, on top of transferring high-speed images and controlling the camera. The Grablink Express PoCL frame grabber interfaces the **smallest and fastest cameras** on the market while still being **safely compatible** with cables and cameras from the previous Camera Link standards.

Support of Camera Link 1.2 Base Configuration -Including PoCL-

The Grablink Express supports the same type of cameras as the Grablink Avenue -see the chart on page 6-.

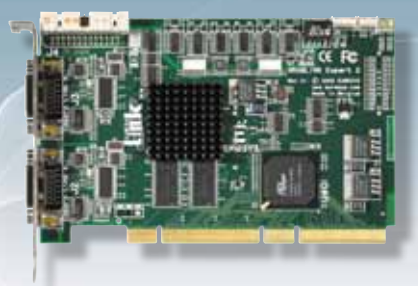
PoCL SafePower

The **Power over Camera Link standard** specifies how to supply power to the camera through the Camera Link connector without losing backward compatibility with the previous Camera Link standard.

- Conventional and PoCL cameras and cables supported
- Over-Current Protection and Over-Voltage Protection circuits
- "SafePower" feature

9 Various External and Internal I/O Lines identical to the Grablink Avenue I/O lines

*Patent granted



GRABLINK Expert 2™

High-Performance Camera Link Acquisition

Dual Base or Medium configurations *-48-bit at 60 MHz-*
16-MB on-board memory
Form factors: Conventional PCI *64-bit 66 MHz bus*
Compact PCI *6U/4HP, 64-bit 66 MHz bus*

The **Grablink Expert 2** is a Camera Link frame grabber for **demanding industrial applications**.

Support of Dual Base or Medium Configurations

CAMERA COMPATIBILITY		Monochrome or Bayer			Color RGB	
		single-tap	dual-tap	quad-tap	single-tap	dual-tap
Tap configuration		Base_1T8, Base_1T10, Base_1T12, Base_1T14, Base_1T16	Base_2T8, Base_2T10, Base_2T12, Medium_2T14, Medium_2T16	Medium_4T8, Medium_4T10, Medium_4T12	Base_1T24, Medium_1T30, Medium_1T36, Medium_1T42, Medium_1T48	Medium_2T24
Camera Link configuration	Base	1 tap x (8-10-12-14-16 bits)	2 taps x (8-10-12 bits)	-	1 tap x (24 bits)	-
	Medium	-	2 taps x (14-16 bits)	4 taps x (8-10-12 bits)	1 tap x (30-36-42-48 bits)	2 tap x (24 bits)

Multiple Windows Of Interest (WOI) Support

With some **specific CMOS cameras**, the Grablink Expert 2 supports their possible feature of acquiring up to **16 WOI in the image**, with **overlapping** of the windows.

26 I/O Lines

The **Grablink Expert 2** is delivered with an auxiliary I/O board implementing the trigger and strobe facilities. On the **Grablink Expert 2 cPCI**, the two I/O connectors are located directly on the front panel.

I/O electrical style

- 4 isolated multi-mode bidirectional I/Os and associated isolated 5V power supply
  - Input: isolated TTL, isolated 12V
  - Output: isolated TTL, isolated open collector, isolated open emittor
- 3 non-isolated TTL inputs and 3 similar outputs
- 16 non-isolated bidirectional CMOS I/Os
- 5V and 12V power supplies

I/O electrical style and function

- TTL trigger or page trigger input
- Opto-isolated trigger or page trigger input
- TTL strobe output
- Opto-isolated strobe output
- TTL line trigger or encoder input
- Opto-isolated line trigger or encoder input

GRABLINK Quickpack ColorScan™

High-Resolution Camera Link Image Acquisition and Pre-Processing for Color LINE-SCAN Inspection

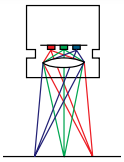
Image pre-processing accelerated by the FPGA *-up to 50MPixels/s-*
Scan-delay compensation *Shading correction*
Look-up table transformation *White balance*

Base configuration *24-bit at up to 60 MHz*
Output formats *RGB 24- and 32-bit packed*
RGB 24-bit planar

128 MB on-board memory
Form factor: ***Conventional PCI*** *64-bit 66 MHz*

The **Grablink Quickpack ColorScan** provides on its **FPGA the accelerated** image pre-processing functions necessary for color scanning applications. Color document scanning or PCB inspections are then considerably eased and accelerated providing on the fly enhanced images ready for further processing.

Image Pre-Processing Functions Accelerated by the FPGA



• **Scan-delay compensation** A trilinear color camera captures the luminance information at three light wavelength ranges from three distinct locations. A gap between these lines analyzed in red, green and blue is resulting due to the sensor geometry and the optical arrangement. The scan-delay compensation offered in the Grablink Quickpack ColorScan gathers the color information coming from three different locations in order to **reconstruct consistent RGB information**.

• **On the fly shading correction on the three color components** After the calibration phase, the six profiles are compiled into the frame grabber hardware to correct the distortions. This correction is handled applying a **multiplicative -gain-** and an **additive -offset-** correction to each pixel issued in the scanned signal. This processing drastically improves the quality of the acquired images facilitating the application processing.

• **Three 8-bit x 8-bit Look-up Table Transformer for the R the G and the B components** They include the following setup methods: exhaustive definition of the transformation law, parametric shaping of the transformation law through a few intuitive controls, white balance by RGB gain correction implemented as special transformation laws.

• **White balance correcting for RGB channel imbalance** This imbalance can be due to differences in sensitivity of sensors, to the illumination system and to the optical filter. After calibration, a **correcting gain** is applied to each color channel to compensate for unbalanced R, G and B components.

Raw acquired image

Scan-delay compensated

Scan-delay compensated and shading corrected image

Scan-delay compensated, shading corrected and white balanced image

Image Acquisition and Transfer

• **Support of Base configuration for RGB LINE-SCAN camera**

Two kinds of RGB imagers are supported: trilinear and 3-CCD. Only RGB single-tap with **Base_1T24** tap configuration is supported.

• **Downweb resampling feature for shutterless cameras**

Most high-resolution color line-scan cameras have no electronic shutter capability. Consequently, they have to be operated at a constant cycling rate in order to maintain a constant sensitivity. The Grablink Quickpack ColorScan implements a unique downweb resampling feature yielding a **defined aspect ratio irrespective of web speed variations**. A built-in rate converter accommodates an off-the-shelf motion encoder to control the line acquisition process, enabling **any programmable aspect ratio**, including perfect square pixels.

2 I/O Lines Available Externally on a DB-9 Connector

I/O electrical style

- 2 isolated multi-mode bidirectional I/Os and associated isolated 5V power supply
  - Input: isolated TTL, isolated 12V
  - Output: isolated TTL, isolated open collector, isolated open emittor
- 5V and 12V power supplies

I/O electrical style and function

- TTL trigger or page trigger input
- Opto-isolated trigger or page trigger input
- TTL strobe output
- Opto-isolated strobe output
- TTL line trigger or encoder input
- Opto-isolated line trigger or encoder input

GRABLINK Quickpack CFA PCIe™

Camera Link Image Acquisition and Pre-Processing for Color AREA-SCAN Inspection

Image pre-processing accelerated by the FPGA *on 8-bit, 10-bit or 12-bit input images -up to 80MPixels/s-*

Bayer Pattern decoder *White balance operator*
Luminance blender *Four LUT operators*

Base Camera Link 1.2 configuration *-24-bit at 85 MHz-*
-Power over Camera Link compliant -PoCL-

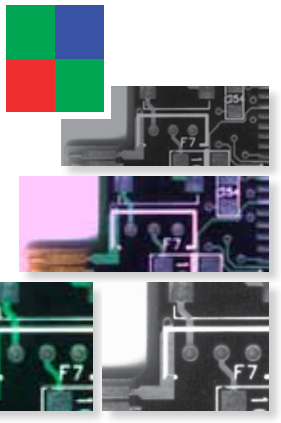
128 MB on-board memory

Form factor: PCI Express *Full-height, half-length, x4*

The **Grablink Quickpack CFA PCIe** -Color Filter Array- offers a set of dedicated on-board pre-processing functions to speed up image processing for applications such as PCB, food or pharmaceutical inspection without loading the host CPU.

Image Pre-Processing Functions Accelerated by the FPGA

All operators are compatible with **8-, 10- and 12-bit input images**.



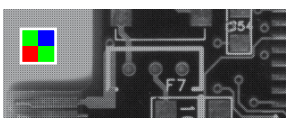
- **A Bayer Pattern decoder** computes the R,G and B components of the image
- **An automatic white balance operator**
  - The white balance parameters can be specified by the user or computed automatically from the image.
  - They can be computed continuously (on each image) or once only (under user control).
  - Moreover, they can be computed from automatically selected white pixels in the image, or from a user-specified region of interest.
- **A luminance blender** computes the Y component of the image
- **Four 16-bit x 16-bit LUT operators** on R, G, B and Y channels

Image Acquisition and Transfer

- **Support of Base configuration for AREA-SCAN single or dual-tap cameras**
  - Bayer pattern color
  - Also compatible with monochrome and RGB cameras

  As a Base Camera Link configuration board, the Grablink Quickpack CFA PCIe supports the same type of cameras as the Grablink Avenue -see the chart on page 6-
- **9 various I/O lines** available on external and internal connectors, similarly to the Grablink Avenue -page 6-
- **Output format**
  - 8-, 10-, 12- and 16-bit components (R, G, B and Y)
  - A wide range of formats is available in the following classes:
    - monochrome
    - Bayer CFA
    - three packed R G B components
    - three planar R G B components
    - four packed R G B a components
    - four packed R G B Y components
    - three packed R G B components + Y component
    - three planar R G B components + Y component
- **Image resolution:** up to 7616 x 4096
- **Trigger decimation**

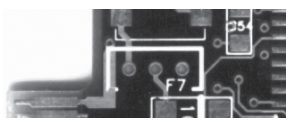
  It controls the acquisition rate from an electrical signal by setting a programmable decimation factor.



Raw image

Bayer pattern decoder

White balance



Luminance blender

Software Support

MultiCam™ Drivers

The **MultiCam driver** enables the consistent control of several Euresys frame grabbers, tusing an arbitrary number of cameras, from **one or several software applications**.

MultiCam allows defining **channels** linking cameras to buffers in the PC memory.

The MultiCam channel **identifies all parameters** ruling the acquisition process from a camera. Every camera feature, such as its type, resolution or image format, is described and controlled through **simple parameters**, considerably easing the camera control task. For each channel-controlled camera, a set of dedicated parameters is created from a CAM file.

Euresys delivers pre-defined files for many popular cameras; still the user can customize his **CAM files**.

➢ *An up-to-date list is available on the Interfacing Cameras web page.*

Multicam drivers available

- MultiCam for Windows 32-bit
- MultiCam for Windows 64-bit
- MultiCam for Linux 32-bit
- MultiCam for Linux 64-bit

Components delivered

- MultiCam for Windows 32-bit and 64-bit
  - MultiCam driver:
    - A 32 bit and 64 bit binary library
    - DirectShow® filters
    - An ActiveX controls library
  - MultiCam Studio
- MultiCam for Linux 32-bit and 64-bit
  - MultiCam driver: a 32 bit and 64 bit binary library
  - MultiCam Studio
- Documentation
- Sample programs

Supported OS

- MultiCam for Windows 32-bit: Windows 7®, Vista®, XP® and Server 2008®
- MultiCam for Windows 64-bit: Windows 7®, Vista®, XP®, Server 2008® and Server 2008 R2®
- MultiCam for Linux 32-bit and 64-bit

  These two MultiCam drivers are designed to be distribution-independent on x86 and x86-64 platforms with kernels versions up to 2.6.31. It is expected to work with a wide range of distributions. Support will only be provided under Red Hat Enterprise Linux 5.2, which is the validated distribution.

Supported development tools

- The 32-bit and 64-bit binary libraries are designed to be used with ISO-compliant C/C++ compilers for the development of respectively 32-bit (x86) and 64-bit (x86-64) applications.
- DirectShow® filters are designed to be used with 32-bit (x86) Microsoft Visual C++ compilers for the development of 32-bit (x86) applications.
- The ActiveX controls library is designed to be used with ActiveX-compatible development tools for the development of 32-bit (x86) applications

Ordering Information

ORDER CODE	DESIGNATION	ORDER CODE	DESIGNATION
1191	GRABLINK Value	1197	GRABLINK Expert 2
1194	GRABLINK Value cPCI	1196	GRABLINK Expert 2 cPCI
1198	GRABLINK Avenue	1501	GRABLINK Quickpack ColorScan
1621	GRABLINK Express	6009	GRABLINK Quickpack CFA PCIe

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