



# 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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**EURESYS™**  
Excellence in vision

# The GRABLINK™ series Comparison Chart

	GRABLINK Value	GRABLINK Value cPCI	GRABLINK Avenue	GRABLINK Express	GRABLINK Expert 2	GRABLINK Expert 2 cPCI	GRABLINK ColorScan	GRABLINK Quickpack ColorScan	GRABLINK Quickpack cPCI
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	64-bit, 66 MHz PCI Full height, half length	x4 PCI Express Full height, half length
Camera Link configuration	Base	Base	Base	Base, dual-Base, Medium	Base, dual-Base, Medium	Base, dual-Base, Medium	Base	Base	Base
Tap demultiplexing incl. tap reversal	✓	✓	✓	✓	✓	✓	✓	✓	Base PoCL Safe Power
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 @ 60 MHz	24 bits @ 85 MHz
Gray scale	✓	✓	✓	✓	✓	✓	✓	✓	✓
Color	✓	✓	✓	✓	✓	✓	✓	✓	✓
Area scan	✓	✓	✓	✓	✓	✓	✓	✓	✓
Line scan	✓	✓	ADP	ADP	✓	✓	✓	✓	✓
Max. delivery bandwidth	90 MB/s	90 MB/s	240 MB/s	180 MB/s	240 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	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/line-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 externally	26 externally	2 externally	2 externally	9 internally & externally
Isol. multi-mode bidirectional I/O* & Isol. 5V power supply -IN (Trigger/Line trigger) OUT (Strobe)-Trigger/Line trigger-	2	2	2	2	4	4	2	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 Emitter. \*\*LVDS and more

# The GRABLINK™ series



**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](http://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.

# 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](http://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 Emitter
- 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)	Extended Base* 2 taps x (8-10-12 bits) 2 taps x (14-16 bits)	- 4 taps x (8 bits)	1 tap x (24 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 emitter
- 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





# 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-.



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)	Base 2 taps x (8-10-12 bits)	Base -	Base 1 tap x (24 bits)	Base -
	Medium -	Medium 2 taps x (14-16 bits)	Medium 4 taps x (8-10-12 bits)	Medium 1 tap x (30-36-42-48 bits)	Medium 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 emitter
- 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™

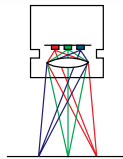
High-Resolution Camera Link Image Acquisition and Pre-Processing for Color LINE-SCAN Inspection

- 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 emitter
- 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.



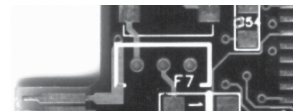
Raw image



Bayer pattern decoder



White balance



Luminance blender



# Software Support

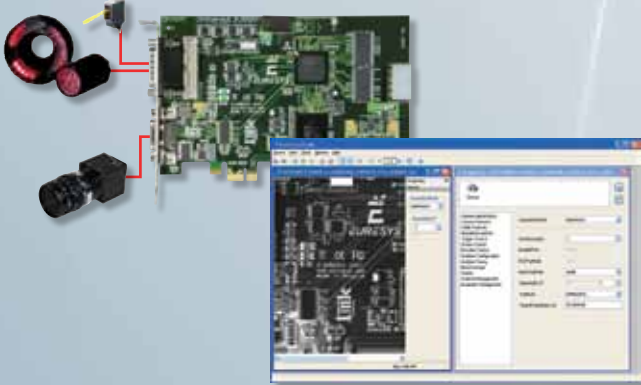
## MultiCam™ Drivers

**Different types of MultiCam drivers are available:**

- **MultiCam for Windows 32-bit** (Windows XP®, Server 2003® and Vista®)
- **MultiCam for Linux 32-bit and MultiCam for Linux 64-bit**

*These two MultiCam products are designed to be distribution-independent with the kernels 2.6.18 and 2.6.24, x86 platforms. Red Hat Enterprise Linux 5.2 is the only distribution validated and for which support is provided.*

**C, C++, .NET classes and ActiveX controls**



The **MultiCam driver** enables the consistent control of several Euresys frame grabbers, using 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 page of the Euresys web site.*

## MultiCam IDEs

Using ...	OS	Environment
MultiCam with C and C++	Windows®	Microsoft Visual C++ 2005
		Microsoft Visual C++ .NET 2003
		Microsoft Visual C++ 6.0
		Borland C++ Builder 2006
		Borland C++ Builder 6.0
	Linux	gcc 4.1.0-28.4
MultiCam with .NET	Windows®	Microsoft Visual C# 2005
		Microsoft Visual C# .NET 2003
MultiCam with ActiveX	Windows®	Microsoft Visual Basic 6.0
		Borland Delphi 2006
		Borland Delphi 6.0

## Euresys Dedicated DirectShow Filters

# Ordering Information

### ORDER CODE

### DESIGNATION

1191	GRABLINK Value
1194	GRABLINK Value cPCI
1198	GRABLINK Avenue
1621	GRABLINK Express

### ORDER CODE

### DESIGNATION

1197	GRABLINK Expert 2
1196	GRABLINK Expert 2 cPCI
1501	GRABLINK Quickpack ColorScan
6009	GRABLINK Quickpack CFA PCIe

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